ADDRESS BY JOHN A. JOHNSON, GENERAL COUNSEL OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, TO THE BRIEFING CONFERENCE ON GOVERNMENT CONTRACTS, SPONSORED BY THE FEDERAL BAR ASSOCIATION AND THE BUREAU OF NATIONAL AFFAIRS, AT THE SHERATON HOTEL, PHILADELPHIA., PA., ON FEBRUARY 13, 1959

Historians of the future will record that the United States, from the legal standpoint, entered the space age when President Eisenhower signed into law the National Aeronautics and Space Act of 1958 on July 29 of last year. At least they will be bound to note that this was the first piece of permanent legislation by the United States Congress which explicitly recognized the importance to the nation of activities in outer space. For the first time in the long history of legislation, the terms "space activities" and "space vehicles" appear in a statute.

This legal innovation stemmed directly from the intense national excitement which followed the successful launching of the Russian Sputniks in the fall of 1957. During the first 3 months of 1958, 29 bills and resolutions concerning outer space were introduced in the Congress. Fourteen of these proposed the establishment of new agencies or the expansion of existing agencies to administer the nation's outer space programs.

On April 2, 1958, President Eisenhower submitted to Congress a special message calling for the creation of a new agency. The President's recommendations were in these words:

"I recommend that aeronautical and space science activities sponsored by the United States be conducted under the direction of a civilian agency, except for those projects primarily associated with military requirements. I have reached this conclusion because space exploration holds promise of adding importantly to our knowledge of the earth, the solar system, and the universe, and because it is of great importance to have the fullest cooperation of the scientific community at home and abroad in moving forward in the fields of space science and technology. Moreover, a civilian setting for the administration of space functions will emphasize the concern of our Nation that outer space be devoted to peaceful and scientific purposes."

"I am, therefore, recommending that the responsibility for administering the civilian space science and exploration program be lodged in a new National Aeronautics and Space Agency, into which the National Advisory Committee for Aeronautics would be absorbed. Hence, in addition to directing the Nation's civilian space program, the new agency would continue to perform the important aeronautical research functions presently carried on by the National Advisory Committee for Aeronautics."

The new Agency, the President said, should have the power to conduct research projects in its own facilities or by contract with other qualified organizations. It would thus be free, said the President, "to enlist the skills and resources required for the space program wherever they may be found, and to do so under the arrangements most satisfactory to all concerned."

After many weeks of intensive hearings during which Congress obtained the views of leading spokesmen for the scientific community as well as the military services, Congress enacted Public Law 568, the National Aeronautics and Space Act of 1958, and wrote into law this declaration of policy and purpose:

"The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind."

After declaring that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities, the Congress further declared that such activities should be the responsibility of, and should be directed by, a civilian agency, "except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States" should be the responsibility of, and be directed by, the Department of Defense.

Now the most significant features in these legislative declarations are Congress' insistence that activities in space should be devoted to peaceful purposes and its decision that such activities should be directed by a civilian agency. By a civilian agency, Congress meant an agency outside of the Department of Defense, directed and staffed by civilians. Accordingly, the Act established such an agency and named it the National Aeronautics and Space Administration.

The Act defines the term "aeronautical and space activity" as meaning (a) research into and the solution of problems of flight within and outside the earth's atmosphere; (b) development, construction, testing, and operation for research purposes of aeronautical and space vehicles; and (c) such other activities as may be required for the exploration of space. The Act further defines the term "aeronautical and space vehicles" as meaning aircraft, missiles, satellites, and other space vehicles, manned and unmanned, together with related equipment, devices, components, and parts. Wisely, the Congress made no attempt to define space activities and aeronautical activities separately, thus recognizing the force of the repeated assertions by both scientific and military leaders that there is no exact line between the air space and outer space, between aeronautics and astronautics, the one regime merging imperceptibly into the other.

Since the division between nonmilitary, or peaceful, aeronautical and space activities, on the one hand, and military activities, on the other hand, is by no means precise, the Act specifies that the President should determine which agency - that is, the National Aeronautics and Space Administration or the Department of Defense - should have responsibility for and direction of each such activity. It is the duty of the President under the Act to develop a comprehensive national program of aeronautical and space activities; to fix responsibility for the direction of major aeronautical and space activities; and to provide for effective cooperation between the National Aeronautics and Space Administration and the Department of Defense in all such activity.

In discharging the duties imposed upon him by the Act, the President is assisted by a new body called the National Aeronautics and Space Council. The Council is composed of the President, the Secretary of State, the Secretary of Defense, the Administrator of the National Aeronautics and Space Administration, the Chairman of the Atomic Energy Commission, not more than one additional member appointed by the President from the Executive Branch of the Government, and not more than three other members appointed by the President from private life. The Council's sole responsibility is to advise the President with respect to the performance of his duties under the National Aeronautics and Space Act.

On a different level, the Act also establishes a Civilian-Military Liaison Committee, which is to facilitate communication between the Department of Defense and the National Aeronautics and Space Administration and provide a means of consultation for those two agencies. The Chairman of the Civilian-Military Liaison Committee is appointed by the President. He is Mr. William Holaday, who is with us this morning as a member of this panel. The Committee also includes one representative from the Department of Defense, one representative from each of the Departments of the Army, Navy, and Air Force, and four representatives from the National Aeronautics and Space Administration.

This, then, is the organizational structure established by the National Aeronautics and Space Act: At the top we have the President providing policy guidance for the entire effort and determining where responsibility for individual projects and activities belongs. The President receives advice from the National Aeronautics and Space Council in carrying out these overall duties under the Act. Directly answerable to the President, and with research, development, and operating responsibilities, are the National Aeronautics and Space Administration and the Department of Defense. All aeronautical and space activities not military in character - and this means, in the language of the Act, not "peculiar to or primarily associated with the develcpment of weapons systems, military operations, or the defense of the United States" - are the responsibility of the National Aeronautics and Space Administration. Bridging the gap that might otherwise appear to exist, and providing a constant channel of communication and consultation, is the Civilian-Military Liaison Committee, with equal representation from both the National Aeronautics and Space Administration and the Department of Defense.

I shall resist the temptation to recount the legislative process by which this historic piece of legislation, Public Law 568 of the 85th Congress, came to be enacted into law, and shall skip instead to the significant events that took place following its approval by the President on July 29, 1958. From now on I shall speak of the National Aeronautics and Space Administration merely as the Administration, or perhaps as NASA, a term which has come to be generally used by those of us who work for the new agency.

Section 202 of the Act provides for the appointment by the President of an Administrator and a Deputy Administrator to head the new agency. On August 8, 1958, the President appointed Dr. T. Keith Glennan, President of the Case Institute of Technology in Cleveland, to be the first Administrator of the National Aeronautics and Space Administration. He also appointed Dr. Hugh L. Dryden, who is with us this morning, to be the Deputy Administrator. Dr. Dryden was formerly Director of the National Advisory Committee for Aeronautics.

On September 30, 1958, Dr. Glennan, acting in accordance with the requirements of the National Aeronautics and Space Act, proclaimed that the Administration had been organized and was prepared to exercise the powers conferred upon it by the Act. By operation of law, the National Advisory Committee for Aeronautics thereupon ceased to exist, and all of its functions, powers, duties, property, and personnel were transferred to the new agency. Thus NASA inherited from its predecessor over 8,000 highly trained personnel, skilled in the sciences and technology required to carry out its responsibilities. It also acquired the Langley Aeronautical Laboratory at Langley Air Force Base in Virginia, the Ames Aeronautical Laboratory at Moffett Field near San Francisco, the Lewis Flight Propulsion Laboratory at Cleveland, the High Speed Flight Test Station at Edwards Air Force Base in California, and the Pilotless Aircraft Research Station at Wallops Island on the eastern shore of Virginia. These facilities had a total original cost of about $350 million.

Ever since its establishment in 1915, the National Advisory Committee had worked closely with the armed services in the research work necessary to provide the military with the most advanced and effective types of aircraft and missiles. This continues to be a responsibility of the National Aeronautics and Space Administration. It is important to keep this fact in mind when considering the functions which the new agency is supposed to perform under the law. While it is a civilian agency, it plays a very important, and in many cases an indispensable, role in the development of military weapons systems through continuation of the kind of research and experimentation which the National Advisory Committee for Aeronautics has carried on for the past four decades.

This was the arrangement desired and foreseen by the President when, in his special message of April 2nd, he had requested that the new legislation provide "for continuing and further enhancing the close and effective cooperation with the military departments which has characterized the work of the National Advisory Committee for Aeronautics." Under such cooperative arrangements, the President said:

> "It is expected that the National Aeronautics and Space Agency will perform research required in the furtherance of strictly military aeronautics and space objectives, just as the National Advisory Committee for Aeronautics now carries on important research work for the military services in aerodynamics, propulsion, materials, and other fields important to the development of military aircraft and missiles."

It would be a most unfortunate error, therefore, to assume, because of Congress' emphasis on the devotion of space activities to peaceful purposes, that the National Aeronautics and Space Administration has no responsibilities in connection with national defense. The National Aeronautics and Space Act prescribes that the aeronautical and space activities of the United States shall be conducted so as to contribute materially to certain stated objectives, one of which reads as follows:

> "The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency."

The next important event took place on October 1, 1958, NASA's first day of business, when President Eisenhower issued Executive Order No. 10783, transferring to NASA all of the functions of the Department of Defense, including the Army, Navy, and Air Force, with respect to certain specific projects.

Under section 302(a) of the National Aeronautics and

Space Act, the President was given the authority for a period of four years after the date of enactment of the Act to transfer to NASA functions, powers, and facilities of any other department or agency of the United States which relate primarily to the functions conferred on NASA by the Act - namely, the responsibility for planning, directing, and conducting aeronautical and space activities for peaceful purposes.

The President has exercised this authority twice. The first time was on October 1st, when he issued the Executive Order I mentioned a moment ago. This Order transferred to NASA the scientific satellite program known as Project Vanguard, which had been carried on under Navy Department direction. In addition, it transferred from the Advanced Research Projects Agency of the Department of Defense responsibility for nonmilitary space projects such as lunar probes and scientific satellites, and also transferred certain space-related projects of the Air Force, principally in the field of "super-thrust" propulsion systems which are primarily applicable to future space vehicles.

The second exercise of the President's authority to transfer functions, powers, and facilities to NASA was by Executive Order No. 10793, issued on December 3, 1958.

By that Order, President Eisenhower transferred the functions and facilities of the Jet Propulsion Laboratory at Pasadena, California, from the Department of the Army to the National Aeronautics and Space Administration. Although the laboratory is a part of the California Institute of Technology, the property occupied and utilized in Pasadena is Government owned. In signing the Order, the President said:

"This decision is necessary in the national interest. It prevents unnecessary duplication and effects economies in space research and development. This development will enhance close cooperation between the National Aeronautics and Space Administration and the Department of Defense to the end that the peaceful use of space will redound to the benefit of all mankind."

Now let us take a look at the laws governing NASA's procurement operations. At the time of its enactment in 1947, the Armed Services Procurement Act, now codified as Chapter 137 of Title 10 of the United States Code, was made specifically applicable to the National Advisory Committee for Aeronautics, in addition to the Army, Navy, Air Force, and Coast Guard. All of its restrictions and procedural requirements, as well as the special authorizations contained in that Act, were applicable to the National Advisory Committee for Aeronautics during the last 11 years of its existence. The National Aeronautics and Space Act specifically amended the Armed Services Procurement Act to strike out the references to the National Advisory Committee for Aeronautics and substitute references to the National Aeronautics and Space Administration. Thus NASA appears to be subject to Chapter 137 of Title 10 to the same extent as are the military services. I say "appears" because section 203(b) of the Act contains a provision which reads this way:

> "In the performance of its functions, the Administration is authorized, without regard to section 3648 of the Revised Statutes, as amended, to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate. . ."

It appears from the legislative history of the Act that this provision may originally have been designed to give NASA a measure of freedom from ordinary legal restrictions in procurement matters not enjoyed by other agencies of the Government. Whatever may have been the original intent, however, the amendment of the Armed Services Procurement Act making it specifically applicable to NASA in the same terms as the military services is so clear and unequivocal that it is our opinion that there are few substantial differences between the legal procurement authority of NASA and the military services. One of the first public announcements made by the Administrator after NASA was established was to the effect that NASA's procurement procedures would conform in every practicable way to the Armed Services Procurement Regulations. Thus industry was given the assurance that it would not have to become acquainted with an entirely new set of procurement regulations in order to do business with this new agency.

In most respects, NASA's legal authority in procurement matters is equivalent to that of the Department of Defense. The most notable exception is in the field of patents, and you will be hearing more about that this morning from Mr. O'Brien and Mr. Dembling. Because of the specific requirements of the National Aeronautics and Space Act, it is not possible for NASA to contract with industry on the same basis as the Department of Defense does with respect to patents. Unlike the Department of Defense, which is under no statutory restrictions in this respect and does, as a matter of policy, only acquire a royalty-free license in the typical research and development situation, NASA is required by law to acquire title to certain inventions made in the performance of its contracts unless the Administrator waives the rights of the United States because he regards such waiver as being in the public interest. Without entering into a discussion of the merits of the Department of Defense practice as contrasted with the legislation under which NASA must operate, I think it must be obvious that such a difference in the legal position of two agencies of the Government, both dealing with the same segments of industry on substantially the same kind of business, is undesirable as a matter of public policy and not in the best interests of the Government's procurement program. Recognizing that the patent provisions of the National Aeronautics and Space Act have caused much concern to industry and the patent bar, NASA will make every effort to administer them fairly and objectively. NASA is making no proposal to Congress for amendment of the patent provisions of the Act at the present time.

There are a few other areas where NASA does not possess the legal authority which the Department of Defense enjoys in relation to research and development procurement. Perhaps the most important of these relates to the authority which the Department of Defense has under section 2354 of Title 10 to indemnify a contractor for research and development against loss or damage to his property and liability to third persons arising from risks defined by the contract as unusually hazardous. Just two weeks ago NASA and the Department of Defense separately sent to Congress their proposals for enactment of legislation which would authorize both agencies to exercise indemnification authority across the board in the entire procurement field, including supply and construction contracts. These two proposals are substantially identical. If enacted in their present form, they will repeal section 2354 and substitute uniform legislation covering the whole procurement area. This legislation is the number one item on NASA's legislative program for this session of Congress; and, if enacted, it will remove a major discrepancy which now exists between the authority of the Department of Defense and NASA in the procurement field.

A few minor areas remain where the law should either be amended or an Executive Order issued to give NASA equivalent legal authority to that of the Department of Defense and the military services. The Assignment of Claims Act is one of these; and NASA now has in process a proposed

Executive Order which will make that Act applicable to our agency and authorize NASA to include a "no set-off" provision in its contracts. Another example is the authority possessed by the military departments under the Defense Production Act to guarantee loans to Government contractors - the so-called V-loan authority. This authority had never been granted to the National Advisory Committee for Aeronautics - undoubtedly because the National Advisory Committee for Aeronautics did not have a sufficiently substantial procurement program to warrant it. This, too, can be corrected by Executive Order, and it is NASA's intention to propose such an Order.

Aside from the exceptions I have mentioned, NASA's situation is almost identical with the Department of Defense so far as the legal aspects of procurement are concerned. Priorities and allocation authority is available to NASA under the Defense Production Act and the Executive Order and delegations which have been issued thereunder. Similarly, NASA has been given authority by the President, along with the Department of Defense, under Public Law 804 of the 85th Congress, which superseded Title II of the First War Powers Act and authorizes any department or agency exercising functions in connection with the national defense to enter into contracts and into amendments of contracts without regard to other provisions of law whenever the President deems such action would facilitate the national defense.

I think it is significant that the fact that NASA is a civilian agency with primary responsibility for non-military aeronautical and space activities does not make it ineligible to exercise authority under Public Law 804, which is phrased in terms of facilitating the national defense. This observation is also applicable, of course, to the Defense Production Act, which refers, in connection with priorities, to promoting the national defense. In our opinion, the entire program of the National Aeronautics and Space Administration is designed to enhance the security interests of the United States and, in the deepest sense, does facilitate and promote the national defense. Executive Order 10789, issued under the authority of Public Law 804, and existing delegations of authority under the Defense Production Act implicitly recognize this fact.

This observation is also pertinent in connection with the section of the Defense Production Act containing the V-loan authority. That section specifically names the military departments and the Department of Commerce as "guaranteeing agencies," but it also authorizes the President to designate additional agencies which are engaged in procurement for the national defense to exercise this authority when "deemed. . . necessary to expedite production and deliveries or services under Government contracts for the procurement of materials or the performance of services for the national defense." We see no reason why NASA, with its important mission related to the national security, should not be legally eligible to exercise this authority pursuant to a designation by the President.

Since NASA came into existence, there have been several very significant and sizeable research and development contracts awarded to industry. The largest of these is the contract with Rocketdyne Division of North American Aviation for a single chamber rocket engine designed to produce a thrust of a million-and-a-half pounds. This contract will run for the next four years and has an estimated cost of approximately $100 million. I think that the history of this particular negotiation is a good indication of the speed and urgency with which NASA is undertaking its job. On October 21st of last year, requests went out to industry for proposals for this work. Proposals were received from six companies on November 24th. On December 12th, NASA announced that the proposal of North American had been selected. North American was asked to send its representatives to Headquarters in Washington on January 5th, prepared to stay until a definitive contract could be negotiated. The definitive contract was completed during the week of January 5th to the 9th as the result of intensive and continuous negotiations. Work was begun on the 10th of January, less than 3 months after proposals were invited.

Another procurement of great significance is the contract which has just been awarded to McDonnell Aircraft Corporation for development of the manned capsule to be used in the man-in-space program, now called Project Mercury. Proposals were solicited for this job on November 17th; the contractors' proposals were received on December 11th, and NASA's evaluation of them completed on January 9th. Negotiations with McDonnell commenced immediately, and agreement was reached on a definitive contract on January 26th. The contract was signed by the contractor on February 5th. It has an estimated cost of approximately $18 million, and calls for delivery of 12 capsules during the next 14 months. It should not be concluded from this, of course, that a man will be placed in orbit during that period of time.

In both these cases, NASA chose not to issue a letter of intent, since it was felt that a definitive contract could be negotiated with no loss of time if both parties would concentrate on the task. Experience in each case bore out this expectation and justified the procedure which was followed. The management of both companies have expressed their pleasure to NASA in the speed with which a definitive contract was concluded. Both of these contracts were negotiated CPFF contracts. They are substantially the same, so far as their terms and conditions are concerned, as would be the case if they had been made with one of the military departments.

To give you some idea of the dimensions of NASA's future research and development contracting program, the President's budget for next year contains almost a half billion dollars earmarked for this new agency. Of this amount, approximately $320 million is intended to be applied to research and development contracts with industry.

NASA's procurement activities in the area of research and development are not confined to contracts made directly between industry and NASA. NASA has broad authority under the National Aeronautics and Space Act of 1958 to use, with their consent, the services and facilities of other Federal agencies, with or without reimbursement; and other Federal agencies are enjoined by the statute to cooperate fully with the Administration in making their services, equipment, personnel, and facilities available to the Administration. Pursuant to this broad grant of authority, NASA has placed a number of orders with the military departments for equipment to be used in its research and development effort which those departments, because of their own programs, can most conveniently procure by contract from industry.

There is one legal point of particular significance to industry in this type of transaction. Section 305(b) of the National Aeronautics and Space Act of 1958 requires that each contract entered into by NASA for the performance of any work shall provide for furnishing to NASA a written report containing full and complete technical information concerning any invention, discovery, improvement, or innovation which may be made in the performance of any such work. The purpose of this provision is to enable the Administrator to make determinations called for by section 305(a) of the Act which determine whether title to a particular invention shall be the exclusive property of the United States. Because of this unyielding legal requirement, we have thought it essential to inform other departments of the Government which are procuring on NASA's account that their contracts with industry must include the NASA patent clause, just as if those contracts were made by industry directly with NASA. If this were not done, an obvious means of circumventing the patent requirements of the National Aeronautics and Sapce Act of 1958 would be opened up.

We are on the threshold of a procurement program that undoubtedly will expand during the coming years beyond the ability of any of us at the present time to predict. It is the intention of NASA to seek all the legal authority necessary to do business effectively and efficiently with industry. In no sense do we wish to be in a less favorable position than the Department of Defense in contracting with industry. Nor do we want a contractor of NASA to be in a less advantageous position than if he were doing business with the Department of Defense. It seems to us that equality of legal authority is desirable across the board. With the necessary legal means at our command, we hope to demonstrate to industry and to the public that NASA can function efficiently and effectively as the agency responsible for directing the nation's nonmilitary aeronautical and space activities.

WAIVERS OF TITLE TO INVENTIONS AND
THE NASA INVENTIONS AND CONTRIBUTIONS BOARD

By Paul G. Dembling
Assistant General Counsel
National Aeronautics and Space Administration
Member, NASA Inventions and Contributions Board
Briefing Conference on Government Contracts
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The National Aeronautics and Space Act of 1958 provides for the establishment of an Inventions and Contributions Board "by the Administrator within the Administration." The functions of the Board are twofold: (1) to evaluate and to recommend to the Administrator for a monetary award any scientific or technical contribution which may have "significant value in the conduct of aeronautical and space activities" without regard to the patentability of the contribution or its conception in the performance of work under NASA contract, and (2) to recommend to the Administrator action to be taken on proposals to waive title to inventions. Both functions of the Board have an effect on the procurement process within NASA. While the waiver function may have greater import in procurement, I will discuss briefly cash awards for scientific and technical contributions. Contributions can originate with the general public; NASA contractors; subcontractors or their employees; NASA employees; and employees of other Government agencies. Each applicant for such an award is entitled to a hearing before the Board and the Administrator will make his determination on the basis of the record. In determining the terms and conditions of any cash award, the Act provides that the Administrator shall take several factors into account: (1) the value of the contribution to the United States, (2) the aggregate amount of any sums which have been expended by the applicant for the development of such contribution, (3) the amount of any compensation (other than salary received for services rendered as an officer or employee of the Government) previously received by the applicant for or on account of the use of such contribution by the United States, and (4) such other factors as the Administrator shall determine to be material.

The Administrator is authorized to apportion the award made for any contribution among two or more contributors, in proportions determined by him to be equitable. An award made for any contribution must be conditioned upon the waiver by the recipient of all claims which he might have to receive any compensation for the use of such contribution. The legislative history of the Space Act indicates that one of the objectives of this provision was to provide a basis for cash award to an inventor when title to an invention was not waived by NASA.

The Administrator may on his own make an award up to $100,000; however, no award exceeding $100,000 may be made until after a complete report regarding the proposed award has been made to the Congress and 30 days have expired after receiving such a report from the Congress.

You will note that the Space Act speaks of scientific and technical contributions in connection with monetary awards. It does not speak of inventions nor patents. Consequently, <u>any contribution</u> of a scientific and technical nature which has significant value in the conduct of aeronautical and space activities may be considered by the Board for a cash award. This could mean a novel application of a patent held by the applicant or even someone else; or an idea or concept which was not patentable.

On December 4, 1958, the Administrator established the Inventions and Contributions Board within the NASA. While no rules and regulations have as yet been promulgated, I would like to indicate some of the problem areas with regard to monetary awards for technical and scientific contributions. One such area is how to handle contributions of Government employees. Another area is how to handle contributions of employees of contractors. How to handle contributions of Government employees creates some problems. The Space Act does not mention property rights of inventions by Government employees. Therefore, what Executive Order 10096, dated January 23, 1950, states, what the role of the Government Patents Board is, and what the Space Act does not say, leads, in my opinion, to possible inconsistencies: (1) Government employees' rights in inventions vis-a-vis contractors' employees' rights; (2) NASA employees' rights and those employees of other Government agencies; (3) rights in inventions of employees of Government agencies that are doing work for NASA under agreement with NASA. I am not going into these matters here today.

I would like to mention, however, that we, in NASA, plan to dovetail the Government Employees Incentives Awards Program and the program under the Inventions and Contributions Board. The Government Employees Incentives Awards Act, which is Section 2121 of Title 5, United States Code, authorizes the head of each executive department or independent agency of the Government to pay cash awards to employees who by their suggestions, inventions, superior accomplishments, or other effort contribute to the improvement of Government operations. Such awards may not exceed $5,000 except awards may be made up to $25,000 with the approval of the Civil Service Commission.

Consideration is also being given to a procedure whereby inventions made by an employee of a NASA contractor or subcontractor in which the NASA has acquired title and, with respect to which preparation for an application for a patent has been authorized, to be submitted to the Inventions and Contributions Board for possible award. The Space Act contemplates as an objective the stimulation of creative thinking to improve the effectiveness of research and development by enhancing the urge to investigate fundamental principles and phenomena in applied research. It is anticipated that this should lead to development of contributions including inventions useful in the conduct of the NASA's activities. Consideration must be given as to how best to accomplish this end. Should awards for inventions be made to individual inventors rather than to contractors as the inventors' employers? Many corporations engaged in work under NASA contracts have general regulations which forbid their employees from accepting compensation of any type from any outside source, especially for services which relate to their official duties. Moreover, the recognition of meritorious contributions of an employee is the responsibility of management and such management would in most instances desire to be consulted before such recognition is accorded employees under their supervision. Perhaps the solution to this problem would be to advise contractors of the fact that the Administrator proposes, upon his own initiative, to have a particular invention, submitted by the contractor, considered for an award to the inventor and to request the contractor's concurrence in the event the Administrator decides to make a cash award. Since there is a lapse of time between receipt of disclosures of inventions made under contract and consideration of such inventions for an award, it is conceivable that in certain instances the inventor may no longer be in the employ of the original contractor. In this event, concurrence in the proposed action by the NASA should be cleared through both the former and present employer. (I might note parenthetically that as of the close of business January 31, 1959, 365 contributions had been received, of which 145 were received in January alone, or at the rate of 7 each working day. Contributions have been received from junior rocket club members, from well-known inventors, and from some of the largest corporations in America. I might also indicate that we are treating all contributions as if they were proprietary.)

It is my opinion that the Congress in granting the Administrator authority to make cash awards for scientific and technical contributions, intended to impose an obligation upon him to utilize this authority to the maximum extent practicable to achieve the purpose of such awards.

Let us now consider the second function of the Inventions and Contributions Board--that of recommending action to the Administrator to be taken on proposals to waive title to inventions. The Act provides that title to inventions and discoveries made pursuant to or as the result of contracts with the NASA shall become the property of the United States under certain conditions: (1) when the inventor is employed or assigned to perform research, development, or exploration work, and the invention is made as a part of his job, or within the scope of his duties regardless of whether made during working hours or with a contribution by the Government of facilities, equipment, materials, allocated funds, information proprietary to the Government, or (2) when the inventor is not hired to do research, development, or exploration work but the invention is related to a contract with NASA, or to his work, or was made either during working hours or with Government contributions. This is the first time that the Congress has established the criteria to be used between master and servant and the first time that such criteria have been employed between the Government and its contractors. It is to be noted that while the Atomic Energy Commission operates under a similar policy of taking title that no such criteria have been established for the AEC.

The Administrator, however, is authorized to waive title to such invention when it is deemed to be in the interests of the United States. However, in such instances a royalty-free license must be retained to use the invention for Government purposes. The Act states "under such regulations in conformity with this subsection as the Administrator may prescribe, he may waive all or any part of the rights of the United States under this section with respect to any invention or class of inventions made or which may be made by any person or class of persons in the performance of any work required by any contract of the Administration if the Administrator determines that the interests of the United States will be served thereby. Any such waiver may be made upon such terms and under such conditions as the Administrator shall determine to be required for the protection of the interests of the United States. Each such waiver made with respect to any invention shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferrable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. Each proposal for any waiver under this subsection shall be referred to an Inventions and Contributions Board which shall be established by the Administrator within the Administration. Such Board shall accord to each interested party an opportunity for hearing, and shall transmit to the Administrator its findings of fact with respect to such proposal and its recommendations for action to be taken with respect thereto."

While no regulations have as yet been issued by NASA under this authority, we, at NASA, have given serious thought to this waiver provision. In advance of published regulations, let me review the principles and procedures which are guiding our actions in this field until such time as regulations are issued. These principles and procedures are as follows.

All requests for waiver of any part of the rights of the United States to any invention made in the performance of any work under a contract shall be by way of petition, addressed to the Administrator. Each such petition shall contain a statement of the facts, accompanied by briefs or memoranda in support of the petitioner's position that the request for waiver of rights of the United States to the invention are in the interests of the United States. A thorough investigation will be conducted by NASA to determine the importance and utility of the invention to the activities of the NASA. Pursuant to this investigation, findings, together with recommendations, shall be prepared and referred by the Office of the General Counsel to the Inventions and Contributions Board. It appears that the interests of the United States will not be served by waiver of any rights with respect to any invention made in the performance of any work under a contract if the invention has significant utility peculiar to or is primarily associated with the conduct of aeronautical and space activities. We do not see how the public interest could be served by giving a contractor a benefit and a right to exclude others from such inventions. If we were to waive this right we would not be carrying out our functions in fostering and advancing useful arts in aeronautical and space activities. In Section 102 of the Space Act entitled "Declaration of Policy and Purpose," the Congress declared that "such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States" except those reserved to the military. Waiving the Government's rights to these inventions would be to waive our responsibilities under the law. We also feel that the retention of the rights in these inventions is a reasonable exercise of eminent domain of the Government. NASA would be subject to severe criticism if inventions in this area were used to hinder research and development in this field.

However, it appears that the interests of the United States may be served by waiver of rights of ownership of the United States with respect to inventions which fall within certain categories which I will discuss that do not have significant utility peculiar to and are not primarily associated with the conduct of aeronautical and space activities. Accordingly, the Inventions and Contributions Board <u>will</u> <u>consider</u> and <u>may</u> <u>recommend</u> waiver of the rights of ownership of the United States in several cases.

Fundamentally, inventions without practical application are useless. The Congress, the patent bar, and writers on the subject all have stated repeatedly that the patent system operates to the public benefit when and if it serves to promote the development of an invention to practical utility. The protection and control provided under the patent laws may have to be invoked to obtain the maximum public benefit and usefulness from these products of research and development. It is the responsibility of the Administrator to waive rights in inventions in order to reduce them to use. Therefore, any invention conceived independently of the performance of any work required by any NASA contract, but first actually reduced to practice in the performance of any work required by a NASA contract, provided that such invention is covered by a United States patent issued to, or application filed by or on behalf of, the petitioner prior to the date of the contract shall be considered for waiver. The United States patent laws provide that an invention is not completed until reduced to practice. A patent application is constructive reduction to practice. When the application is filed an absolute property right is created. Therefore, we feel that it would be inequitable if NASA took this property right. As Dr. Vannevar Bush has stated: "Invention, today, is seldom a matter of a flash of inspiration. It is far more often the result of arduous work, by a group of individuals, who push the extent of knowledge in a particular field beyond that of their contemporaries, and thus finally grasp ways in which their new concepts can produce new materials, or combinations, or devices, which will meet public needs and desires. This is the way in which most of our practical progress occurs. It is very hard to justify research of this sort on practical matters, expensive as it is, and without guaranty of useful results, if the products which ensue are immediately to become public property, to be copied at will by competitors."

A second category for waiver consideration would be for any invention which, although made in the performance of any work under a contract, has predominant commercial utility and only incidental utility in the conduct of aeronautical and space activities, on verified showing by the petitioner that manufacture of the invention on a quantity basis would be started if the right to ownership by the United States is waived and a United States patent on the invention is granted upon application filed by the petitioner. The petitioner must agree to furnish to the Administrator, within one year subsequent to the grant of any patent on said invention, a statement under oath showing the monies expended in the manufacture of the invention and the number of items manufactured. Perhaps the manner in which this could be handled would be by granting an exclusive license to the contractor for a limited period of time with certain strings attached to assure that the invention was being worked.

A third category for waiver consideration would be for any invention for a basic material where development of such material was not a contemplated or express purpose of any work under the contract, and with respect to which the contractor agrees to file an application for patent without direct cost to the Government. Some materials are so basic to our economic structure that even if the Government retained patent right, there would be no perceptible effect on the price of such material. Here we have to rely on industry to produce the material. It is not the policy of the Government to enter in the production business. If the Congress considers this to be a type of monopolistic condition which it wishes to curtail, it has other ways than through NASA contracts.

A fourth waiver area would be for any invention that is directed specifically to the contractor's line of business, and with respect to which the contractor's expenditure of its own funds for research and development has been large in comparison to the total value of research and development contracts placed by NASA with the contractor in the field of technology to which the invention pertains. This is a matter of balancing the equities in the situation.

A fifth category would be a waiver on the basis of lack of interest. Any invention which is not used or is not likely to be used by or for the Government and with respect to which an application for patent will not be filed by NASA will be considered for waiver.

In cases where the interests of the United States will not be served by waiver of rights of ownership of the United States it nevertheless appears that the interests of the

United States may be served by the waiver of the United States' rights in the invention to the extent that such waiver takes the form of a grant of a nonexclusive license to the contractor and this only in those instances where the invention does not have significant utility peculiar to or is primarily associated with the conduct of aeronautical and space activities. Accordingly, the Inventions and Contributions Board will consider and may recommend waiver of the United States' rights of exclusion in such cases. For those of you concerned with the aircraft industry, such license shall be subject to the obligations, if any, of the contractor under terms and conditions of contractors' agreements, for example, "Cross License Agreement of the Manufacturers Aircraft Association, Inc." in effect as of December 31, 1928, as supplemented by the agreement of September 30, 1935.

The interests of the United States may also be served by the waiver of title to the foreign rights of the United States with respect to any invention not falling within the scope of those made in performance of any work under a contract if the invention has significant utility peculiar to or primarily associated with the conduct of aeronautical and space activities. Accordingly, the Inventions and Contributions Board will consider and may recommend waiver of title to the foreign rights of the United States with respect to inventions in such cases. The petitioner may be granted the exclusive right to file applications for patents on each invention in any foreign country within six months from the date of the grant of such waiver. The petitioner, however, must agree to notify NASA within the six-month period as to each foreign country within which such an application has been filed. Any interest we would have in the practice of an invention in foreign countries would arise by way of treaty or agreement. The license we would reserve under a waiver would be sufficient for our purposes. There appears to be no purpose served by our getting involved in commercial uses of the invention in foreign countries. It might actually be advantageous to the Government if the contractor would file a foreign application to perfect the patent rights.

We hope that regulations on this subject of waiver will soon be available for comment by all interested parties. It is the intent of NASA to invite and give careful consideration to suggestions from the public before these regulations are finally promulgated. In the interim we will be guided by the principles and procedures I have outlined.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

February 17, 1959

Hold for Release Until
Launched or Scrubbed

No. 1
EX 3-3260
Ext. 6325

VANGUARD SATELLITE LAUNCHING VEHICLE 4

Satellite Launching Vehicle 4 is approximately 72 feet long and 45 inches in diameter at its base. It is finless, or integral tank construction and has a gross take-off weight (with propellants) of 22,600 pounds.

The Martin Company is prime contractor for the vehicle.

The liquid propellant first stage has a gimballed engine built by General Electric Company. In essence this stage is a guided booster. Its propellants are liquid oxygen and kerosene.

The second stage also is a liquid propellant rocket, employing white fuming nitric acid and unsymmetrical dimethylhydrazine. Its gimballed engine and fuel tanks are provided by Aerojet-General Corporation.

The second stage contains the "brains" of the entire launching vehicle -- the complete guidance and control system used during three periods of flight: (a) first stage powered flight, (b) second stage powered flight, and (c) second stage coasting flight. The second stage houses within its nose the third stage rocket and the satellite. The protective nose cone breaks away during second stage powered flight.

The mechanism for "spinning" the third stage is contained in the second stage. At the completion of the second stage coasting flight the rocket should be at a proper angle or "attitude" to discharge the third stage into an orbital path. Minneapolis-Honeywell Regulator

Company, Air Associates, Designers for Industry, and the Martin Company provide the guidance and control system for the second stage.

The third stage is a solid propellant rocket. It consists of a cylindrical case, a nozzle, propellant charge and igniter, and is without steering controls. Two companies have contracts for third stage Vanguard engines -- Grand Central Rocket Company and Allegany Ballistics Laboratory. Grand Central made the third stage engine in Vanguard SLV 4. (If deemed advisable, stage separation times may be given out during this briefing.)

The U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J. developed the instrumentation in the cloud cover atellite.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C. February 17, 1959

..ld for Release
Until Launched
or Scrubbed

EX. 3-3260
Ext. 6325
No. 4

UNITED STATES CLOUD COVER SATELLITE
INSTRUMENTATION, TRACKING AND DATA REDUCTION

The United States Cloud Cover Satellite is a 20-inch diameter, 21½-pound sphere containing two photocells mounted behind circular, gridded windows which project from opposite sides of the satellite.

The primary objective of the experiment is to measure the distribution of cloud cover over the daylight portion of the sphere's equatorial orbit -- during an expected lifetime of two weeks -- and relate it to the overall meteorology of the earth. The experiment represents a first step toward obtaining continuous weather mapping of global scope.

The Cloud Cover Satellite is a National Aeronautics and Space Administration project. It will be launched by Vanguard Satellite Launching Vehicle 4, tracked and interrogated by NASA's worldwide Minitrack network. The U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J. developed the cloud cover instrumentation package in the satellite, the shell of which was prepared by NASA's Vanguard Division.

Here, in brief, is how it works:

Clouds, sea and land masses have different qualities of reflection which can be translated into electrical impulses. As the satellite's photocells sweep the sunlit side of the earth, the intensities of sunlight reflected from the cloud areas (80 per cent), will differ from the land (15 to 20 per cent) and sea (five per cent) areas. These reflections, converted to electrical signals, are stored in tape recorder within the satellite for telemetering to ground stations (one per orbit) in compressed form when the satellite is interrogated from same.

The photoelectric cells project diametrically opposite each other at 45 degrees from the satellite's stable spin axis. They are placed so that one will always sweep the earth if the satellite stays within an expected maximum altitude or apogee of 1,600 miles. (Planned perigee: 200 to 300 miles.) Only one photocell, therefore, will see the cloud's and earth's surface reflectivity at any time.

The satellite will criss-cross the equator between latitudes of approximately 35 degrees North and 35 degrees South.

During its (approximately) 16 orbits every 24 hours, it is expected to reveal cloud cover data over the northern latitudes of the earth between the equator and 35 degrees to 40 degrees north.

Most of the area south of the equator will be in varying degrees of darkness if the experiment is launched on schedule and matters go according to plan.

The satellite's 24-hour sweep should reveal cloud cover data over about 25 per cent of the earth's sunlit surface in 600-mile-wide strips. However, the foregoing will depend upon the many variables of ultimate apogee, perigee, orbital period, etc.

INSTRUMENTATION

Here is a brief description of the instrumentation:

The instrument container -- five-and-one-half inches in diameter, 12 inches long -- is suspended upright inside the sphere. The electronic instruments and mercury batteries are arranged in decks within the container.

A 108.03 megacycle transmitter to send cloud cover data at one watt and a 108.00 megacycle transmitter to send Minitrack tracking information at 10 mw are included in the package. The 108.00 megacycle transmitter carries a temperature-sensitive crystal which reveals the temperature within the scientific payload.

(Expected life of the cloud cover instrumentation: two weeks; expected life of the Minitrack transmitter: four weeks.)

Also within the tightly-packed, can-shaped container: a magnetic recorder containing a 75-foot loop of quarter-inch erasable tape which operates when the photocells are scanning the sunlit side of the earth during 50-odd minutes of its expected orbital period of 95 to 115 minutes.

Solar cells, tucked behind the gridded, three-inch in diameter, windows, operate a switch which halts the tape when the satellite is in the shadow of the earth, thus conserving battery power. The tape is reactivated by the same means.

When the satellite passes over the appropriate tracking station -- depending upon the satellite's location at the time -- it is interrogated from the ground and transmits its 50 minutes of data in one 60-second burst.

The data already telemetered to the ground are erased from the tape. A trigger resets the system to begin recording again.

The cloud cover data from each global circuit will be stored on a separate tape at the ground station which interrogates it (see below).

TRACKING

NASA's worldwide Minitrack network will follow the satellite with its radio angle tracking system utilizing a miniaturized radio transmitter within the satellite (described above) and a chain of 11 ground tracking stations. The Minitrack system was designed by the Naval Research Laboratory and built by Bendix Radio Division.

The stations:

Blossom Point, Md.; Fort Stewart, Ga.; Havana, Cuba; Quito, Ecuador; Lima, Peru; Antofagasta, Chile; Santiago, Chile; Antigua, BWI; San Diego, Calif.; Woomera, Australia and Esselen Park, Union of South Africa.

The Army Signal Corps has installed special FM sub-carrier recording units in the following stations which will be interrogating the satellite: Fort Stewart; San Diego; Lima; Antofagasta; Santiago and Woomera.

It is expected that the satellite will release its first full 0-minute data on signal from San Diego upon completion of its first orbit.

The data, which will be stored on half-inch-wide tape, will be sped to Fort Monmouth for data reduction. Tracking data will flow from the stations into the Vanguard Control Center at the Naval Research Laboratory, Washington, D. C., thence to the Vanguard Computing Center in Washington, D. C. and finally, to Fort Monmouth.

SLV 4 will also attempt to place the 50-pound third-stage rocket casing into orbit. The casing will be treated with a special coating for optical tracking.

The satellite shell -- developed by the NASA Vanguard Division -- consists of micro-thin layers of magnesium, zinc, copper, silver, gold, chromium, silicon-monoxide, aluminum and a final outside coating of ilicon-monoxide. Total thickness of the highly-polished, electro-plated shell: .0015-inch.

The high reflectivity of the shell (it should have the brightness of a fifth or sixth magnitude star) and the makeup of its constituent layers are designed to provide an average internal temperature of 86 degrees Fahrenheit, with a low of about 50 degrees and a high of about 140 degrees.

Data Reduction

The tapes containing the cloud cover data will be fed into an electronic complex at Fort Monmouth which will transform them into crude photographs. These film strips (one earth's circuit = 35 to 40 feet of film) will be fitted together in the manner of aerial photographs.

The system whereby the data is converted to black and white photographic strips includes an FR 100 tape recorder, analog computer, data reduction unit, oscilloscope and a 35 mm camera.

- END -

RECENT TRENDS IN AERONAUTICS AND SPACE RESEARCH

IN THE UNITED STATES

Hugh L. Dryden
Deputy Administrator
National Aeronautics and Space Administration

(Address before the Canadian Aeronautical Institute on the occasion of the Special Meeting celebrating the 50th Anniversary of Flight in Canada, Montreal, February 23, 1959)

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Introduction

It is a great pleasure for me to meet with you on this anniversary of the first flight of an airplane in Canada, which was also the first within the British Empire. I join with you in paying tribute to J. A. D. McCurdy, Canadian pioneer of flight. His presence reminds some of us that we belong to the generation which saw man leave the surface of the earth in controlled flight through the air. My friend, J. H. Parkin, and I have witnessed and played a small part in the amazing developments of a half century that have brought us conquest of the air and the beginnings of the exploration of interplanetary space. Our collaboration and friendship have been typical of the neighborly cooperation of the citizens, institutions, and governments of Canada and the United States. On this historic occasion I bring you greetings from my colleagues in the Institute of the Aeronautical Sciences and in the National Aeronautics and Space Administration, a new U. S. governmental agency for research and development in aeronautics, space science, space technology, and space flight.

My assignment on this occasion is that of looking toward the future, to look at the sweep of events from the flight of the "Silver Dart" through the past to the present and toward the future. Rather than compete with the writers of science fiction or with prophets who claim to discern clearly the wants of several decades in the future, I will concentrate on the trends of the recent past and their extrapolation into the near future.

In July of 1953 I was maneuvered into publishing in Aero Digest a prophecy of developments in aeronautics for the next fifty years. The prophets of the past were classed as pessimists, fence-straddlers, and optimists, and the future was viewed through the eyes of each group. I would like to quote two paragraphs.

"If there is any twentieth-century aspiration which corresponds to that of the nineteenth century for conquest of the air, it is perhaps that of the conquest of space with the early goal, travel to the moon.

Like the concepts of flight during the nineteenth century, these concepts of space travel are the results of attempts of imaginative men to apply the technology of their day to the problems of interplanetary travel. It may well be that success will await a still broader basis of experience in science and technology, experiment and more experiment, and unanticipated scientific developments. Let us again listen to Dr. Optimist as he speaks in nearly the same terms as one of the prophets of fifty years ago."

"'There are few today who do not look forward with feelings of confidence that space flight will some day be accomplished. All that we require is to make rocket motors somewhat larger than those already in existence. To accomplish this all that is required is the pooling of skills already available and a good deal of money. Taking into consideration the speed at which guided missiles travel, that at which models have been propelled, the experimental data available from hypersonic experiments in wind tunnels and ranges, and the theoretical calculations which have been made, we may reasonably suppose that a satellite vehicle is entirely practicable now and that travel to the moon is attainable in the next fifty years'."

Five and one-half years have passed since these words were written. The first satellite was launched a little over a year ago. In recent testimony before the U. S. Congress I stated that we could have a lunar expedition within ten to fifteen years if the necessary financial and other resources were allocated to this project. Another scientist testified that he thought it could be done within seven and a half years. Such has been the effect of the first step into space on our thinking.

Rather than engage in a contest of prophecy, let us turn our attention to recent trends in aeronautical and space research in the United States. We will find that progress has been evolutionary except for a few step-like jumps, as radically improved propulsion systems became practical. We will find that we now have before us another step-like jump connected with the development of large rocket engines. We will find new factors. No longer can a McCurdy or a Lindbergh pioneer the next advance. The dimensions of space exploration are too large. Pioneering nations replace pioneering individuals. Space exploration is the prerogative of the largest and most powerful nations of the world; perhaps it will require ultimately the support and cooperation of all mankind.

Turbojet Engines and the Supersonic Age

Powered flight was made possible by the development of reciprocating internal combustion engines. This type of engine grew in performance and reliability through the first half-century of flight, enabling steady advances in the performance of civil and military aircraft. During the last war, American manufacturers turned out 257,000 such engines in a single year. The air war was fought and won with aircraft equipped with piston engines and propellers.

On August 27, 1939, unknown to the rest of the world, the Germans flew a Heinkel 178 airplane powered by a radically different type of power plant, the turbojet. There began a technical revolution which advanced aircraft performance at an unprecedented rate to that of our present-day jet fighters, jet bombers, and civil jet aircraft.

These performance gains were not wholly due to the development of the turbojet engine. Simultaneous developments were required and made in other branches of technology. Jet engines had limited utility in the aircraft in which they were first flown. We had to learn to postpone compressibility effects, to reduce drag at transonic speeds by use of sweepback and thinner wing sections. A new concept of design, in which the entire configuration of wings and fuselage was shaped to give a smooth distribution of cross-sectional area along the axis of the fuselage, produced tactical military aircraft with useful supersonic performance. These aerodynamic improvements were made practical by the development of new materials and structural designs and the solution of aero-elastic and flutter problems. Thus the phenomenal increase in rate of advance of aircraft performance was made possible by the new type of power plant accompanied by harmonious and coordinated rapid progress in the development of the new power plants, airframe configurations, materials, and structures.

Initiated by the inventive development of the turbojet engine, the technical revolution early made its presence felt in a drastic reorientation of aeronautical research programs. In the U. S., the National Advisory Committee for Aeronautics on January 18, 1941 began construction of a major new laboratory at Cleveland to be devoted solely to research on flight propulsion. It had been planned in terms of piston engines. In May of the same year the British made the first flight with Whittle's jet engine in the Gloster airplane, a development quite independent of the earlier German jet engine. Following the entry of the United States into the war, intensive research was initiated on the new type of power plant and on its applications in aircraft design. The NACA Flight Propulsion Laboratory was completely re-equipped for this work and its programs of research drastically changed.

Studies of the possibility of supersonic flight were begun by the NACA in 1942 but no suitable power plant was then available. It was proposed to carry out supersonic research by flight tests, because the wind tunnels then available became useless at speeds near that of sound. In 1944 a cooperative program was initiated by the Army, Navy, and the NACA. A liquid fuel rocket engine was selected as the power plant and air-launching from a mother aircraft provided higher performance than could be obtained by an aircraft designed for take-off from the ground. Flights of research airplanes contributed aerodynamic and structural data and operating experience to the development of tactical supersonic military aircraft powered with improved turbojet engines.

Rockets, Missiles, and Hypersonic Flight

I have noted that the "break-through" to turbojet powered supersonic aircraft depended not only on a new device but on timely and appropriate developments in aerodynamics, materials, and structures. In the "break-through" to the rocket-powered hypersonic ICBM missile we find no single new invention, but the simultaneous maturity of developments in many fields. The principles of rocket propulsion are inherent in Newton's laws of motion. Small rockets were developed centuries ago. In the United States Dr. Robert H. Goddard began experimental work in 1914. In 1929 he fired a small rocket using gasoline and liquid oxygen as propellants. His work was little appreciated at the time. Only when German scientists and engineers unveiled the 12-ton V-2 rocket did the rest of the world re-examine the potentialities of rocket propulsion.

The development of the intercontinental ballistic missile has been made possible by the rapid development of the V-2 type rocket coupled with new developments in light-weight structures, in light-weight but powerful nuclear warheads, in the art of guidance, and in means for dealing with the problem of aerodynamic heating on re-entry. The high priority given to the development of this weapon system has attracted research effort to the relevant fields of science and technology.

Thus in recent years NASA Research Centers, formerly laboratories of NACA, directed increased research effort to the problems of aerodynamics at hypersonic speeds. The objectives included more fundamental understanding of the airflow at hypersonic speeds characteristic of re-entry of ballistic missile nose cones to the atmosphere, including the high temperatures developed, the physical and chemical changes in the air near the nose cone and their effect on the flow. Theoretical and experimental studies of heat transfer, forces applied, and stability were made. One of the techniques developed at the NASA Wallops Island Research Station is illustrated in Fig. 1. The figure shows a five-stage missile research rocket which can be fired to an altitude of about 100,000 feet by means of the first two stages. The last three stages are fired on a descending path to simulate re-entry conditions of ballistic missiles. The rocket shown attains a re-entry speed of over 3 miles per second (Mach number 16). Temperatures, heat transfer, and other data are obtained by radio telemetering. Many research groups in the United States, Great Britain and Canada now use this technique.

In 1952 H. J. Allen of the NASA Ames Research Center contributed the concept of the high-drag blunt nose cone to minimize aerodynamic heating. All current ICBM and IRBM nose cones employ this concept. Extensive studies of the heating, drag, and stability have since been made by NASA and by industry groups in the U.S.

New laboratory techniques were developed for tests of high temperature materials under conditions approaching those encountered during re-entry of ballistic missile nose cones. Fig. 2 shows a ceramic-heated jet at the NASA Langley Research Center capable of testing specimens of materials in a 4000°F airstream from 4 to 12 inches in diameter. Fig. 3 shows a specimen under test in this jet. Temperatures of 12,000°F are attained in the electric-arc powered air jet shown in Fig. 4. These tools indicate the trends of research within the last few years in aerodynamics, heat transfer, and materials with special reference to ballistic missile applications. The basic data obtained are more widely applicable to the corresponding problems of any hypersonic vehicle.

NASA research on rocket engines in recent years has been both theoretical and experimental. Theoretical studies have been made of rocket cycle thermodynamics, flight dynamics, and calculation by use of digital computers of the combustion gas composition and temperature under a variety of conditions, and of the vehicle performance that may be realized. Experimental work has included the fundamentals of propellant mixing and atomization, reactivity of fuel-oxidant combinations, ignition and starting at high altitude and low temperature, combustion instability, and heat transfer.

Hypersonic Aircraft

NASA Research Centers have for the past decade advocated and carried out in cooperation with the Air Force and Navy research on the problems of future aircraft through the use of specially designed research airplanes. The original series, X-1, X-2, X-3, D-558-1 and D-558-2, are well known. The Bell X-2 exceeded a speed of three times the speed of sound and reached an altitude in excess of twenty-five miles.

Two years before the X-2 made these records, NASA made a proposal for a follow-on airplane to explore the adjoining higher speed range and to study some of the problems of manned flight into nearby space. This proposal resulted in another cooperative project for the X-15 research airplane which will soon begin its flight program. This airplane is designed to reach altitudes where aerodynamic forces are negligible. Small rockets are provided for space controls. Re-entry into the atmosphere may be studied. The materials and construction of the X-15 have been designed to withstand surface temperatures during re-entry up to 1200°F. Possible flight plans permit several minutes of weightlessness. Thus the pilot may gain experience with this condition which may be encountered in space flight.

The X-15 program has included associated studies by means of laboratory simulators of man's ability to control the vehicle both within and beyond the atmosphere. The requirements for stabilization and control of the X-15 were formulated in the light of these studies.

More recently NASA Research Centers have been making an intensive study of the feasibility of a research hypersonic glider with an airframe capable of flight at all speeds up to statellite velocity. Such a glider could be boosted to high altitude and speed by the use of rockets, and then glide for long distances within the upper atmosphere. Such a vehicle would be capable of exploring the problems of manned space flight and re-entry at extreme speeds. One of the many configurations under study in wind tunnels is shown in Fig. 5. The figure shows a large dynamically scaled model in free flight in a large slow speed wind tunnel to study approach and landing behavior.

Research on the Problems of Space Flight

The interest of NACA in the research problems of space flight began in a formal sense with a presentation by the late Robert J. Woods of Bell Aircraft Corporation to his fellow members of the NACA Committee on Aerodynamics at its regular meeting on January 30, 1952. Mr. Woods urged basic research on the mechanics and problems of space flight and the establishment of a concept of a suitable manned test vehicle and the building of such a vehicle as soon as possible. The latter recommendation led to the X-15 research airplane program already mentioned.

The first part of the recommendation led to the design and construction of special research facilities and a fairly extensive reorientation of the research programs of the NACA laboratories in aerodynamics, propulsion, and structures. At first this effort was directed mainly toward and integrated by the X-15 project.

More recently the studies have been oriented to provide basic information needed in the design of recoverable manned satellites and true spacecraft.

Many new wind tunnels with unique features have provided the means for closer simulation of the flight environment. These include low-density wind tunnels, special hot wind tunnels for heat transfer studies, and hypersonic wind tunnels using air and helium. Small tunnels using air provide speeds up to a Mach number of 10. A large new wind tunnel will provide a hypersonic air stream with stagnation temperature in the 2500° to 3000°F range. Helium has been used in small wind tunnels to simulate Mach numbers up to 20, and larger helium wind tunnels are under construction.

One of the most valuable research tools is the hypersonic ballistic range which provides both the speed and the corresponding stagnation temperature at the full-scale values. Fig. 6 shows the flight test chamber of the Ames Research Center's ballistic range with the many photographic stations for recording attitudes and shock wave patterns at various points along the flight path. The models are launched by a light gas gun which propels them down the range at speeds of 15,000 feet per second or more. In air the intense heating raises the temperature to the point where the air at the nose is luminous and in some cases melting or burning may occur. Fig. 7 shows the luminous trace of a magnesium projectile at 12,000 feet per second. By substituting other gas mixtures for air, conditions corresponding to flight in the atmospheres of other planets can be simulated.

The Ames Atmosphere Entry Simulator (Fig. 8) consists of a high-velocity gun and a hypersonic nozzle which is so shaped that the flow of high-pressure air accelerated through it duplicates the way in which the density of the earth's atmosphere decreases with altitude. A model launched at full re-entry velocity along the axis of the nozzle toward the small diameter high density region duplicates the decelerations, stresses, pressures, and temperatures of actual re-entry.

In the propulsion field, the requirements of spacecraft propulsion have brought special research emphasis on nuclear and electric propulsion systems. The nuclear facility of NASA at Plumbrook Arsenal near Sandusky, Ohio shown in Fig. 9 provides a 60 megawatt research reactor to further research on the effects of heat and radiation on power plant materials and components.

For propulsion in interplanetary space in extremely weak gravitational fields there is great interest in ion or plasma jets accelerated by electrical means because of the extremely low propellant consumption as compared with other power plants.

This advantage is accompanied by the disadvantage of small thrust and large power plant weight. One of the new facilities used for the study of ion rockets is shown in Fig. 10.

The structures of space vehicles are not subject to large gravitational or other forces when in free space. NASA has been interested in extremely light-weight inflatable structures for special applications in space, specifically to reflectors of radio waves for communications applications. A sphere 100 feet in diameter weighing only 75 pounds has been constructed. It can be packaged for firing into satellite orbit in a sphere only 2 feet in diameter. Fig. 11 shows an inflatable corner reflector about 12 feet in diameter.

These examples indicate some of the directions in which research is moving into the problems of space flight and the types of equipment being provided. There are many more, such as space environmental chambers, simulators of many types, including the closed-loop type at the Navy's Johnsville Centrifuge with a human pilot exercising control motions feeding computers which compute the resulting motions of hypothetical vehicles and feed the accelerations to the pilot.

The Exploration of Space

The launching of the first man-made satellite on October 4, 1957 brought a realization of the potentialities of the exploration of space and of the practicality of much more rapid progress. The National Aeronautics and Space Administration was created in the United States to enter upon a comprehensive program not only of research in aeronautics and space but also the development and operation of space vehicles for research purposes, and the exploration of space by unmanned and manned vehicles. A brief general survey of the U.S. national space program will perhaps serve to look toward the future.

Our first satellites and space probes have been assembled from components already on hand or requiring only a short time to build. The basic first stage rockets available are those developed for ballistic missiles. Only the Vanguard system was specially developed to launch satellites. The payload capability was small.

The payload of a satellite or space probe is a rough indication of the magnitude of the task that can be accomplished, whether the mission is scientific or military. It is a direct function of the rocket thrust available and of the optimization of the staging of the vehicle system. An early task of NASA was the planning of a program of rocket and vehicle development which would provide for all the desired missions with a minimum number of new rockets and new vehicles. There are available from the ballistic missile program, Jupiter, Thor, Atlas, and Titan boosters. For increased thrust, two new developments have been started in the U.S.; -- (1) a cluster of existing engines to give an early capability of about 1-1/4 million pounds thrust, and (2) a new single-chamber rocket of 1 to 1-1/2 million pounds thrust, which can be clustered to give 6 million pounds thrust.

In addition to these first stage boosters, suitable upper stage rockets are under development, including some using high energy fuels. It appears that the number of sizes required will be small, perhaps no more than four. Nuclear rockets are being developed by the Atomic Energy Commission and the National Aeronautics and Space Administration as is the general application of nuclear energy for various purposes in the exploration of space.

This major segment of the program, which we may characterize as advance in space technology, also includes the improvement of guidance and communication systems, stabilization and control, power supplies and other components of space vehicles.

The U.S. national space program includes a manned satellite project, called Project Mercury. The objective is to begin the manned exploration of space by developing the booster and vehicle technology needed to place a man in orbit about the earth for a short time and recover him safely. By restricting the altitude to a height well below the Great Radiation Belt discovered by Van Allen, no heavy shielding is required. By planning for only a few orbits before recovery, existing life support systems are adequate and psychological factors are somewhat simplified. In fact the philosophy adopted is to use the simplest approach based on presently available state of the art.

There is agreement that the simplest approach is to place the man in a capsule substituted for the nose cone of an intercontinental ballistic missile. Fig. 12 shows a cross-section of the capsule for which a contract has been let with McDonnell Aircraft Corp. The man is supported in a reclining position on a couch molded to fit his body and located so that the launching acceleration and the deceleration on re-entry will act transverse to the body axis. This sytem has been thoroughly tested at the U.S. Naval Air Development Center at Johnsville, Pa., where volunteers have safely withstood accelerations of the order of 20g without injury.

The capsule contains equipment to supply oxygen and remove carbon-dioxide, communications and navigation equipment, attitude control jets, retro-rockets to reduce speed for re-entry, a heat shield to protect the man from re-entry heating, and parachutes for final landing on water.

Safety has been a primary consideration. An escape rocket is mounted on a pylon on top of the capsule to enable ejection and recovery of the capsule in event of failure of the booster system either on the launching pad or in the pre-orbital trajectory.

The operational aspects of tracking and recovery and the proof testing of the capsule and its systems will be developed in steps, beginning with instrumented capsules, animal passengers, and finally man; first in short ballistic trajectories at low initial speeds; then in several steps at increasing speed until orbiting speed is reached. Only when recovery has been demonstrated on instrumented capsules and with animal passengers with high reliability will the first astronauts make their flights. Fig. 13 shows a schematic view of the various occurrences in an orbiting trajectory.

The selection of the first group of space pilots is already in progress so that the selected group may live with the project from the beginning. These men are university graduates, and also graduates of one of the military test pilot training schools, with a minumum of 1500 hours of flight time. They are younger than 40 and not taller than 5' 11". They are now undergoing extensive physical and psychological tests. Project Mercury is being pursued with great urgency and with the support of the military services and the Advanced Research Projects Agency of the Department of Defense.

We are beginning a program of practical applications of satellites to peaceful uses, particularly meteorological research and weather forecasting and to communications. At 10:55am on February 17th Vanguard II, carrying equipment for studying the cloud cover of the earth, was launched into an orbit with perigee of 335 miles and apogee of 2050 miles. The satellite of Project SCORE demonstrated some of the potentialities of a communications satellite. These first demonstrations will be followed by a series of successively more sophisticated meteorological and communications satellites. When sufficient booster capacity is available to put large payloads in the 24-hour orbit, we can look forward to extensive use of satellite communications world-wide and of great capacity, including the possible transmission of television programs world-wide. Meteorological satellites will then provide weather observations over the whole earth over land and sea to form the basis of more accurate weather forecasts.

Satellites will also be applied to improve methods of navigation and geodetic surveying.

The first satellites constituted a part of the international scientific cooperation of the International Geophysical Year which ended Dec. 31, 1958. Remarkable advances in knowledge of the nearby space environment were obtained with the small scientific payloads of these interim vehicles, all but Vanguard assembled largely from existing components. New phenomena were discovered, of which the most publicized is the radiation belt or belts discovered by Van Allen. From this excellent beginning we are moving forward with an ongoing space science program. Leading scientists in the United States are participating through the Space Science Board of the National Academy of Sciences in formulating the scientific objectives and specific experiments and as associated scientists in the conduct of the experiments. Sounding rockets, satellites, and deep space probes, some aimed to pass near or orbit the moon and planets, are being procured to transport the scientific equipment into space.

The scientific experiments in the established program include as a high priority item the study of energetic particles and their interaction with the earth's atmosphere and magnetic and electric fields. Cosmic ray intensity in interplanetary space, makeup of particles of various energies in the radiation belt, nature of auroral particles are examples of measurements to be made.

The program for the study of electric and magnetic fields includes satellite and probe investigations with magnetometers out to great distances and in the vicinity of the moon, Mars, and Venus. Measurements will be made as close to the sun as possible.

Many features of the atmospheres and ionospheres of the earth and planets are of great scientific and practical interest.

Finally, as booster capacity increases, we can develop orbiting astronomical observatories to study features of the universe in all wave lengths of radiation unmarred by the distortion and opacity of the earth's atmosphere. We can also test the general theory of relativity by comparing the rate of a highly accurate atomic clock in a weak gravitational field far from the earth with that of a clock in the larger field at the earth's surface.

These areas, -- (1) advance in space technology; (2) beginning of human exploration by manned satellites; (3) satellite applications to meteorology, communications, navigation, etc.; and (4) scientific study of the space environment by sounding rockets, satellites, and deep space probes carrying scientific instruments; -- indicate the trends. From these we will go on in due course to journeys to the moon and planets and return, to orbiting laboratories and space platforms, and other more difficult space missions.

I prefer to stop here with Wilbur Wright in saying that "it is not necessary to look too far into the future; we see enough already to be certain that it will be magnificent."

Concluding Remarks

I am today a guest among Canadian friends and it would be presumptuous of me to look into the crystal ball for Canada's role in the exploration of space. I am pleased to tell you that NASA and the Department of Defense have concluded arrangements to continue the program of research on nearby space with sounding rockets at Fort Churchill, Canada, which was started during the International Geophysical Year. In addition cooperative research has been arranged between NASA and Canadian scientists using Canadian developed apparatus and experiments. Canadian scientists will also participate in the study of radio transmission from satellites carrying special purpose transmitters. On this note of positive evidence of Canada's entry into space science, I wish to conclude by praising the early enterprise of Canada and its current strong position in aeronautics and expressing the wish that Canada's first steps in the exploration of space are but harbingers of similar great progress in the next half century.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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FOR RELEASE UPON DELIVERY
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By T. Keith Glennan, Administrator
National Aeronautics and Space Administration
Annual Meeting, Cleveland Technical Societies Council
Cleveland, Ohio
February 27, 1959

In the short time permitted me, I would like to tell you briefly about the origin, function, and organization of NASA - then something of the relationships between NASA and the Deparmtment of Defense which also plays a vital role in the nation's space program - something of the scope and possible future course of that program (I assure you I will try to stay off of Cloud 9 in that recital) -- something of the particular technical problems that face us and of the probable costs to the nation as we push ahead in this new field of scientific inquiry and technological development. Perhaps, in conclusion, I can relate these activities to the importance that I believe resides in the activities of institutions such as your own -- and something of my own thinking on our response, as a people, to the important challenges that face this nation.

Following three months of debate last spring, the Congress enacted and the President signed into law on the 29th of July, 1958, the National Aeronautics and Space Act. Declaring the policy of the United States to be "that activities in space should be devoted to peaceful purposes for the benefit of all mankind," the Act declares that such activities shall be the responsibility of and shall be directed by a civilian agency exercising control over aeronautical and space activities of the United States -- with the important exception that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the nation, including pertinent research and development activities, shall be directed by the Department of Defense. Provision was then made for the President to determine, in cases of disputes over jurisdiction, whether the civilian agency or the military departments should be responsible for a particular project.

Perhaps the most important duty placed on the President by the Space Act is that of developing "a comprehensive program of aeronautical and space activities to be conducted by agencies of the United States." Preparation of such a program for ultimate approval by the President has been delegated to NASA with the assistance and cooperation of the Department of Defense. To advise him on this and other matters, the Congress provided for the appointment, by the President, of a Council -- The National Aeronautics and Space Council with the following membership:

The President -- as chairman; The Secretary of State; The Secretary of Defense; The Chairman of the Atomic Energy Commission; The Administrator of NASA; Another person from government -- this year, the Director of the National Science Foundation, and three members from private life eminent in the field of science, engineering, technology, education, administration, or public affairs. Each of these public members must be confirmed by the Senate.

Apparently assuming that there would be ample opportunity for debate between the civilian and military agencies over individual project jurisdiction, the Act provides that the Space Council will advise the President on the allocation of responsibility for particular activities and on the resolution of disputes over areas of jurisdiction.

One further evidence of Congressional interest in maintaining a flow of information and increasing collaboration between the civilian and military programs was the establishment of a Civilian-Military Liaison Committee. As presently constituted, in addition to the Chairman, there are four members of this Committee representing the military -- one from each of the services and one from the office of the Secretary of Defense -- and four members representing NASA.

Thus far, it has been possible to agree on the division of labor as between the military departments and NASA. Whether or not the present division of effort is sound and will continue unchanged is not clear to me. This space business is in its infancy. We have very little of the fundamental information necessary to the undertaking, with assurance, of many of the systems about which there has been much talk and speculation. Operational systems of interest to the military need much exploratory research and development work before we can be sure of their usefulness or effectiveness. For the moment, however, you can rest assured that over-lapping and duplication is at a controlled minimum, and that the interchange of information between agencies is at a reasonably satisfactory level.

But I was going to tell you a bit about the make up and organization of NASA before I drifted off into that discussion of inter-agency relationships. As you may know, the Space Act provided for the absorption by NASA of the personnel and facilities of the NACA organization -- some 8,000 scientists, engineers, and supporting personnel -- and the great laboratories, now known as Research Centers, at Langley Field in Virginia, Moffett Field in California, and here in Cleveland at Hopkins Airport. Smaller, but very important activities, are the High Speed Flight Station at Edwards Air Force Base in California, and the Rocket launching facility at Wallops Island on the Virginia Coast.

On the first of October, 1958, we officially set up shop, absorbed the NACA and accepted the transfer of the Vanguard project from the Naval Research Laboratory. Before the end of November, more than 200 able scientists had transferred to NASA from the Naval Research Laboratory including the bulk of the Vanguard project personnel and some fine scientists interested in upper atmosphere research.

On 3 December, the Jet Propulsion Laboratory in Pasadena, California, was transferred to NASA from the Army by a Presidential Executive Order. Operated by the California Institute of Technology under contract to NASA, this laboratory employs 2,300 people on a variety of research and development projects in propulsion, guidance and control, and tracking and telemetry, as well as the design and construction of scientific payload packages. Presently the responsible systems contractor on the Sergeant missile, this laboratory will be phased out of the Army's program by early 1960 and will be active entirely on space projects.

By the end of June, 1959, NASA will employ 9,000 people in addition to the 2,300 on the roles at the Jet Propulsion Laboratory. The fiscal year 1960 budget contemplates a further increase of 1,000 employees, largely in the engineering and science areas, by June 1960. Beyond that, I would not care to predict except that I am committed to the idea of keeping the governmental establishment as small as we can, consistent with maintaining an in-house ability to manage the business in an intelligent and aggressive manner.

As to the program, it is necessary that we understand that NASA is an agency devoted to research, development, and exploration in aeronautics and space. Thus you would expect to find and, indeed, you do find in our program a broad underlying base of activities in the sciences. This effort is divided into several major fields of interest among which are studies of atmospheres (both our own and those in space and in the vicinity of other planets) ionospheres, energetic particles, electric and magnetic fields, gravitational fields, astronomy, and bio-sciences. There is, as you can imagine, considerable overlap among the different areas, and study of these various inter-relationships will be an important part of our space sciences program.

This work must be carried out by use of instrumented satellites and space probes. Initially, these have been relatively small payload packages capable of sensing and providing information on a few of the phenomena encountered. Already, however, a sufficient amount of information of a novel character has been collected to make it imperative that second-generation, more difficult experiments be undertaken. Under the direction of our Space Sciences Division just such a program has been laid out with the aid of recommendations from a number of sources, including particularly the Space Science Board of the National Academy of Sciences. In the years ahead, it seems clear to me that this sort of program will grow, not so much in numbers of experiments, but in complexity and cost. Simple, single purpose experiments will give way to those that will involve much more sophisticated instrumentation in satellite and space probe packages capable of making a variety of measures of phenomena simultaneously.

By such use of satellites and space probes, we expect to accomplish one of the major objectives of our national space program --- the enrichment of knowledge --- the gaining of a better understanding of the earth on which we live, of the moon and the planets, and of the nearby and distant space environment. I can't give you dollar amounts for the pay-offs resulting from this kind of effort. I can't say how soon those pay-offs will be realized. But I can say that I believe sincerely that, in the relatively near future, satellites will be widely used in meteorology, and in world-wide communications. Experts in those fields estimate that the value of such advances will be counted in the billions of dollars annually. These are not my figures, but there seems to be evidence to support such predictions.

Impressive as such returns may appear to be from our scientific exploration in this new environment, I have an inner conviction that in the years to come, there will be other, more important gains from what we learn in space. They will be ones we don't even anticipate today. If the historic pattern is followed, they will be ones that will dwarf those we see only dimly today.

There is another aspect of space flight which, in my opinion, is of the utmost importance...attainment of the ability for man himself to travel into space, when he will, where he will, as far as he will.

There may be some who will wonder about the usefulness of attempting manned flight into space in view of the present limited knowledge about the space environment. But man, himself, is the best piece of instrumentation we know about. No amounts of instrumentation that we can devise will tell us as much about the moon, or Venus, or Mars, as man himself will be able to report, once he has visited those distant spheres.

Sending man safely into space is an arm-stretching, mind-stretching undertaking that thrills every one of us. It commands all our energies, all our enthusiam, all our determination. By requiring from all of us our very best, Project Mercury will result in much earlier development of the technology needed for other difficult space missions.

These are the missions we must undertake and successfully perform. The astronomer knows that if he can use his telescope outside of the earth's atmosphere he will be able to extend his ability to see and to understand a great deal more about the universe and the galaxy of which we are a part. Similarly, scientists interested in other branches of knowledge hope to sweep away barriers to enable a more complete understanding of the physical and biological processes of which they now have only limited understanding. What I am here emphasizing once again is the fact that our objective in working in space is the acquisition of new, fundamental knowledge. From the applications of that knowledge will come the processes and systems which, if used wisely, should benefit mankind the world over.

This sounds like a surprisingly simple task, doesn't it? The present state of the art in propellants, in communications, instrumentation, electronics,and a variety of other areas of applied science permits our undertaking these tasks. What lies ahead is an engineering and management job of impressive dimensions and great difficulty. For you, as engineers and managers, let me point out the important problem areas that call for solutions if we are to be able to send aloft the scientific instrumentation and, ultimately, man himself to gain the new knowledge we seek.

Broadly speaking, the areas of greatest concern to us are those of propulsion, of vehicle guidance and control, of tracking and the acquisition of data, and the reduction of that data -- great quantities of it -- to a form useful to the experimenter. Dealing with these one by one, and briefly, it is necessary first to understand that the propulsion or booster systems we now use were developed for ballistic missiles, with the single exception of the Vanguard rocket system which has only very limited payload capability. That the Jupiter, Thor, and Atlas are meeting the requirements of their ballistic missile mission seems to be in question. And for the first-generation experiments in space, it has been possible to so modify them that additional rocket stages of lesser thrust could be carried by them in place of a warhead. A good and useful ad hoc sort of job has been done but the scientific payload carrying capacity leaves much to be desired as we move to the second-generation of experiments.

To provide the increased thrust required two new developments are under way -- the first, a cluster of existing engines to give a capability, hopefully by 1962, of $1\frac{1}{4}$ million pounds of thrust as a first stage booster rocket and second, a new, single-chamber engine of 1 to $1\frac{1}{2}$ million pounds thrust which ultimately can be clustered to provide 6 to 9 million pounds of thrust. In addition to these first stage boosters, suitable upper stage rockets, some using high energy fuels, are under development. The purpose is to produce a family of space vehicles to be assembled from a minimum number of booster and upper stage rockets to perform whatever range of missions may be desired. Longer range developments include work on nuclear propulsion by the Atomic Energy Commission and on ion and plasma jets. These systems seem particularly suitable for propulsion in interplanetary space. Important work on high energy propellants and on these advanced propulsion systems is being carried on at the Lewis Research Center here in Cleveland.

It is necessary at this point to note that we are undertaking -- indeed, we must undertake, -- developments in rocket systems which match and in some cases exceed in complexity, the ballistic missile rockets now in use by the military. And you are aware, I am sure, that the ballistic missile business is not a cheap business.

Moving on, it is clear that the requirements for precision in placing satellites in orbit and in directing probes to particular points in space will require substantial improvements in guidance and control systems. It is equally clear that there is little use in carrying out these experiments unless we have a completely adequate system for tracking and for receiving data transmitted from outer space. And the reduction and analysis of that data is a task of tremendous proportions.

As I have pointed out earlier in this discussion, our scientists cannot get on with the task of acquiring the new knowledge we seek until our engineers and those of our contractors solve the many difficult engineering problems that face us. These are rapidly changing times, technologically speaking. The engineer dealing with these matters must stretch himself to keep up with the advancing state-of-the-art. Here, the fine educational work of organizations such as this Technical Societies Council can plan an important part in improving the understanding and capabilities of its members in the many areas of technology involved.

In conclusion, I would like to have you understand a bit of what is involved in this program in the way of money. NACA -- our predecessor organization -- was operating at a level of $100,000,000 when it was absorbed by NASA last October. Transfers from the military, appropriations granted, and supplemental appropriations now under consideration by the Congress will provide us the total sum of $384,000,000 for this fiscal year. We have requested $485,000,000 for fiscal year 1960. Our counterpart organization in the Pentagon -- the Advanced

Research Projects Agency -- will spend perhaps $325,000,000 in fiscal year 1960. Thus we are already planning to operate at a level in excess of $800,000,000 annually in our second full year of space exploration for both civilian and military purposes.

I spoke earlier of the propulsion systems under development. If this program is carried out as now planned, it will cost more than 2 billion dollars in the next 6 to 8 years. The man-in-space project (Mercury) most certainly will involve expenditures of more than $2,000,000 by the time we have completed the first successful manned orbital flight. Only the other day, testifying before a Congressional Committee, I guesstimated that within two years, civilian space activities would require support at an annual rate of one billion dollars or more. As Dr. Dryden, the highly respected Deputy Administrator of NASA has said, "This is an expensive game that only big nations can play." To date, only two such nations are really in the race -- Russia and the United States.

As of the present time, the Soviets possess propulsion systems of much greater thrust than ours. This situation arises largely out of the fact that they started in this business six or more years earlier than we did. It will continue to prevail for at least eighteen months. In that time period, it is wholly possible -- even probable -- that they will place a manned satellite in orbit. If we were to have available to us billions of dollars a year instead of the hundreds of millions we now have, we could not shorten by any appreciable amount the span of time which must elapse before we have thrust capability adequate to our space tasks. As I have said before in other public statements, money can buy time to a limited extent -- it more often will provide insurance by making possible the pursuing of several alternate courses of action and development simultaneously. Much as I would like to say to you that we will be the first to put a man into space -- and that largely because of world-wide prestige that will certainly attach to such an accomplishment -- I can only say that we are driving ahead with all our energies and pushing present state-of-the-art knowledge to its limits on this project.

I have talked money costs, but there are others. One of the heaviest of these costs will be measured in terms of effort...unrelenting, determined effort by tens of thousands of talented scientists, engineers, and artisans... If we are to excel in space, we will do so in competition with others for whom there are no thoughts of the 4-day week or the 7-hour day.

I have said that the dollar costs will extend over the years. So will our efforts to train the technical brainpower that will be needed. As president-on-leave at Case, it may be only natural that I call for more rigorous education of our youth. But I speak as a plain citizen when I quickly add that unless all of us demonstrate our beliefs by our own willingness to work long and hard to succeed in our space efforts and, in fact, everything else we do as a nation, then we can't be surprised if our youngsters forsake their books for the joys provided by jukeboxes and convertibles.

Just wishing won't make our dreams come true. The Russians know this fact. We need to relearn it.

- END -

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No. 2
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JUNO II FACT SHEET

The Juno II carrier rocket used in the U. S. space probe experiment is based upon the Army-developed JUPITER Intermediate Range Ballistic Missile. The rocket consists of a modified JUPITER serving as the first stage and a three-stage cluster of solid propellant rockets placed in a spinning tub mounted in the nose of the first stage.

The rocket is 76 feet long and weighs about 60 tons or 120,000 pounds when fueled.

Main Stage Propulsion

The JUPITER booster was modified for this special space role to increase fuel capacity. Fuel for the booster propulsion system is a high grade kerosene; oxidizer is liquid oxygen.

The vehicle's tank area begins at a point above the space occupied by the thrust unit. Bulkheads separate the engine compartment from the liquid oxygen tanks, these tanks from the fuel tanks, and the fuel tanks from the instrument compartment at the upper end of the first stage.

The smooth outer shell of the JUPITER booster is also the inner wall of the storage tanks. It is fashioned from aluminum alloy rolled from flat sheets.

A bell-shaped thrust chamber is used to combine high altitude efficiency with maximum performance at low altitude. The chamber is gimballed to allow use of the engine exhaust stream in controlling direction. To provide cooling for the chamber during operation, fuel for the engine circulates through the chamber walls before being fed through the injector into the combustion area.

Upper Stages

The upper stages of this launching vehicle were originally developed for the JUPITER-C by NASA's Jet Propulsion Laboratory. The upper assembly is fitted into a rotating "tub" or launcher, which gives stability in post-separation flight, much as a rifle bullet is stabilized by spinning. The base of the tub is mounted on a bearing. Below the bearing and forward of the first stage instrument compartment are electric motors which spin the bucket and its cluster of rockets up to 750 RPM. Spinning is initiated shortly before liftoff and is gradually increased in speed.

The second stage consists of 11 solid fuel rockets aligned in circular fashion forming a hollow cylinder. Weight of second stage: 721 pounds.

The third stage, weighing 207 pounds, consists of three solid fuel rockets positioned in triangular fashion equidistant from each other.

The third stage sits in the center of the ring formed by the second stage motors. After second stage burnout, the third stage ignites and pulls out of its encasement.

The third and fourth stages and the instrumented payload continue to spin.

The fourth stage is a single rocket motor weighing 59 pounds. When it burns out it is separated from the probe itself by a small explosive charge and spring, which push the payload ahead of it.

Shroud

A specially-designed shroud encases the launching vehicle's high-speed upper assembly and payload. The shroud has three main functions: to protect the assembly from the heat generated by air flow friction; to eliminate the dynamic forces to which the upper stages would otherwise be subjected; and to provide support for the arrow-like angle-of-attack meter which is required in this configuration to give adequate control during initial stages of flight.

Guidance

The guidance and control systems are located in the forward portion of the first stage and provide the only source of guidance after liftoff. The missile must "think" for itself and adjust to its environment. The only ground-to-rocket control is the destruct system installed for range safety.

The Juno II's guidance and control equipment is also employed in the JUPITER IRBM. It is a highly accurate system known as "Delta Minimum Inertial Guidance Scheme." In general terms it functions as follows:

The heart of the device is known as a stabilized platform, so named because, through the use of gyroscopes, it remains in a stable position during the entire flight.

On the launching pad the rocket is first oriented in the general direction of the target. Then the small stabilized platform, located in the upper section of the rocket, is aligned very precisely to the target.

Data for a pre-calculated trajectory are recorded on a tape in the guidance computer aboard the rocket. These instructions can be changed by remote control up to within 20 minutes of firing time. From the moment of lift-off through the entire propelled flight, the platform is held to the same angular direction. The rocket tilts and arcs through the sky, but the platform remains constant, or "space-fixed."

Mounted on the platform are acceleration devices which measure with great accuracy any deviation that Juno II makes from the pre-set path. The deviations usually result from changes in wind direction and velocity. Information on deviations is fed into the vehicle's computer, and the necessary corrections are issued automatically by the system's components to keep it continuously constrained toward its goal.

After the corrections have been issued by the "brains" of the guidance system, the vehicle's course is altered accordingly by a special attitude control system of air nozzles, with variable thrust, and by a swivelling nozzle on the booster engine.

Firing Procedure

The rocket takes off vertically. During the burning time of the first stage, it is tilted into trajectory inclined at a predetermined angle. A few seconds after cutoff, the booster (combined tank and engine section of first stage) is separated from the instrument compartment by the ignition of explosive bolts. Wrapped around the bolts are coil springs. When the explosions destroy the bolts, the springs exert a gentle push on the instrument compartment and separate it cleanly from the booster. This is followed by the firing of four small lateral kick rockets contained in the booster which cause the booster to slow down and move to the side. This eliminates any possibility of the booster interfering with the flight of the separated upper stages.

The booster falls to the earth, while the upper assembly continues on its trajectory. The upper element coasts for nearly ne minute. The nose cone of the shroud is removed by explosive bolts and springs, and a lateral kick rocket moves it to the side. Shortly after this, the second stage of the rotating upper assembly within the shroud is ignited. The assembly, now rotating at about 550 RPM, rapidly pulls out of the shroud, and the third and fourth stages are fired in quick sequence. After the fourth stage boosts the probe's velocity to nearly 25,000 miles per hour, the burned-out motor case separates, leaving the instrumented payload to continue its journey into space.

- END -

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SPACE PROBE BACKGROUND AND OBJECTIVES

On March 27, 1958, the Advanced Research Projects Agency of the Department of Defense announced a series of five experiments -- three by the Air Force, two by the Army -- designed to gather data from the vicinity of the moon and beyond. The series was planned as part of the U. S. contribution to the International Geophysical Year.

After the first ARPA-Air Force lunar probe (August 17, 1958), the remaining experiments were transferred by Executive Order to the National Aeronautics and Space Administration on October 1, 1958.

Here is a brief review of the tests carried out to date:

On August 17, 1958, the Air Force Ballistic Missile Division, under ARPA direction, launched the first U. S. lunar probe. An engine failure in the first stage of the four-stage Thor Able I rocket caused the vehicle to blow up 77 seconds after lift-off. (The probe was not named.)

The second lunar probe attempt by AFBMD -- and the first under NASA direction -- took place on October 11, 1958. The probe, christened Pioneer I, traveled 71,300 miles into space and was deemed a qualified success.

The next AFBMD-NASA lunar probe attempt, on November 8, 1958, ended when the carrier rocket's third stage failed to ignite. This was Pioneer II.

The fourth test was a deep space probe on December 6, 1958, by NASA with the assistance of the Army. Pioneer III revealed valuable radiation data and, like Pioneer I, was considered a qualified success.

The upcoming experiment is being conducted by NASA with the assistance of the Army. It is the fifth and last in the U.S.-IGY series being completed by NASA. There will be later non-IGY lunar and space probes.

The objectives of this test are similar to those of the December 6 experiment:

...To achieve an earth-moon trajectory.

...To probe the physical limits of the Great Radiation Belt (the two so-called Van Allen radiation belts discovered by the Army's Explorer satellites and Pioneer III).

...To determine the extent of radiation in the vicinity of the moon.

...To test a photoelectric sensor which will react to the light of the moon and report this fact back to earth with audible radio pulsations. The sensor will be activated when it gets about 140,000 miles from earth. When it reaches about 20,000 miles from the moon, the sensor will start to sent its radio pulsations. (See Instrumentation release.)

Participants in Project

NASA's Jet Propulsion Laboratory at California Institute of Technology, Pasadena, California, developed the second, third and fourth stages of the Juno II rocket, the scientific payload and prepared trajectory data. Dr. William H. Pickering is Director of JPL. Dr. J.E. Froehlich is JPL's space probe project director.

The first stage, a modified Army Jupiter IRBM, was developed by the Army Ballistic Missile Agency (ABMA), Huntsville, Alabama. ABMA is an element of the Army Ordnance Missile Command. Maj. Gen. John B. Medaris is commanding general of AOMC. ABMA is also responsible for assembling and launching Juno II and for carrying out the early tracking phase. JPL directs the long-range tracking phase.

Hundreds of industrial fabricators and suppliers have contributed to the Jupiter first stage of Juno II. The Chrysler Corp., Detroit, Michigan is the Jupiter prime contractor, although the booster used in this project was fabricated by ABMA at Huntsville. Chrysler furnished engineering services and some hardware.

Major Jupiter subcontractors are: Ford Instrument Co., Long Island City, New York, guidance and control components; Rocketdyne Division, North American Aviation, Canoga Park, Calif., propulsion. Reynolds Metals Co., Sheffield, Ala., normally constructs ballistic shells for Chrysler - produced Jupiter. For this project, Reynolds built the shell of the rotational launcher.

A Word About JPL...

JPL is a government-owned research and development facility operated by Cal-Tech for NASA. Covering more than 80 acres in the upper Arroyo Seco near Pasadena, California, JPL today is staffed by 2,300 professional and technical personnel provided by Cal-Tech.

Included among these specialists are recognized leaders in such fields as chemistry and materials, electronics and instrumentation, aero-dynamics and engineering.

The mission of JPL is three-fold: (1) To originate, develop, and test new guided-missile systems. (2) To conduct supporting research investigations in the physical sciences for the purpose of acquiring basic data applicable to the varied aspects of weapon-system development. (3) To undertake feasibility and evaluation studies of proposed and/or previously initiated programs of special interest to the nation.

The JPL Pasadena installation includes 20- and 12-inch supersonic wind tunnels (a third tunnel for hypersonic testing is being constructed), as well as individual laboratory and associated facilities for fundamental research. Combination laboratory and test facilities provide for the application of basic research data to controlled tests. Also maintained at JPL are processing units and test cells for propellant testing and evaluation. An instrumentation installation, connected with major test facilities and furnished with a variety of equipment, facilitates the recording and reduction of test data. The formal documentation of all aspects of these various research and development projects is one of the chief products of JPL. The laboratory also maintains a library of 150,000 volumes -- one of the nation's most complete compendiums of scientific literature relating to jet propulsion and to other fields pertinent to guided missile development.

The Laboratory has four external facilities: a static-testing area for testing large rocket motors at Edwards Air Force Base, Muroc, California; a field-testing operational unit for missile flight tests at the Army's White Sands Proving Ground, Las Cruces, New Mexico; additional testing facilities at the Atlantic Missile Range and the Goldstone Tracking Station at Camp Irwin, Calif.

A Word About ABMA ...

ABMA embraces key installations engaged in rocket, missile and space programs in Alabama and New Mexico.

The Command is charged with all Army Ordnance responsibilities in the missile-space field. This includes development, production, storage and maintenance of Army rocket and guided missile weapons systems, and conduct of space projects as assigned by NASA and ARPA.

AOMC's resources and capabilities cover a wide range, from prototype production of the JUPITER IRBM, basic research in many areas, test facilities, and the launching of long-range rockets and space vehicles. Fourteen major weapons systems are under its jurisdiction. Annual expenditures in support of these programs are about two billion dollars.

Redstone Arsenal, Ala., serves as headquarters for the Command, the ABMA, and the Army Rocket and Guided Missile Agency. Also under the Command are White Sands Missile Range and the post command at Redstone Arsenal.

Total personnel strength of the Command is about 29,000 persons of whom 6,000 are military and 23,000 are civilians. Of the latter, more than 4,000 are employed by Army contractors operating on the installations.

ABMA, commanded by Brig. Gen. J. A. Barclay, is America's first agency created exclusively for the performance of technical service responsibilities for long range ballistic missiles and space vehicles. This encompasses research and development, fabrication of components, prototype production, static testing and launching, and resolution of logistics support and field maintenance problems.

ABMA programs, in addition to space research, include the REDSTONE, PERSHING and JUPITER ballistic missiles. Facilities include a large twin-vertical test stand, cold calibration stand, blockhouse, development shops and assembly buildings capable of fabricating complete missiles; metallurgy, rubber and plastics laboratories, a computation laboratory and supporting facilities. The plant is ideally suited to the development and prototype production of large rockets.

Dr. Wernher von Braun heads the Agency's Development Operations Division. Development Operations consists of 10 laboratories: Aeroballistics, directed by Dr. E. D. Geissler; Computation, Dr. H. Hoelzer; Fabrication and Assembly Engineering, Hans H. Maus; Guidance and Control, Dr. Walter Haeussermann; Research Projects, Dr. Ernst Stuhlinger; Missile Firing (at Cape Canaveral), Dr. Kurt Debus; Structures and Mechanics, W. A. Mrazek; Systems Analysis and Reliability, E. W. Neubert; Test, Karl Heimburg; Systems Support Equipment, Hans Hueter.

The present strength of ABMA is about 6,800, of whom 5,000 men are Civil Service employees, 360 military, and 1400 contractor.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

February 28, 1959

Hold for Release
Until Launched or
Indefinitely Delayed

No. 4
EX. 3-3260
Ext. 6325

SPACE PROBE TRACKING NETWORK

The tracking of the U. S. space probe to be launched by a Juno II rocket consists of two principal phases -- powered flight and space flight.

The U. S. Army Ballistic Missile Agency, Huntsville, Alabama, (an agency of the Army Ordnance Missile Command) is charged with the first phase. The National Aeronautics and Space Administration's Jet Propulsion Laboratory at California Institute of Technology, Pasadena, Calif., is responsible for the second phase.

The first phase ends about four-and-one half minutes after launch when -- all stages having fired -- propulsion ceases and the probe becomes a body moving on a tracjectory through space.

During the initial period, Army tracking stations at Cape Canaveral and Miami, Fla., Fort Stewart, Ga., Huntsville, Alabama, and the Ballistic Research Laboratory, Aberdeen, Md., follow the probe. The data are fed directly into the Computations Laboratory at ABMA, Huntsville, where they are reduced and fed into a computer.

The computer then determines the payload velocity; the vector angle (angle at which the payload is travelling with relation to the earth's surface) and the relation of the actual flight path to the planned flight path. These data are sent to JPL, Pasadena.

The second phase begins about four to five minutes after launch when a 10-foot diameter JPL tracking antenna at Mayaguez, Puerto

Rico, picks up the probe and holds it for the next five or six hours by which time the probe should have traveled about 50,000 miles -- the limit of its tracking capacity.

Before Puerto Rico has lost the probe below its horizon, JPL's 85-foot diameter space tracking radio telescope at Goldstone Dry Lake in Camp Irwin, Calif., will acquire the signal and lock onto it for the next nine or ten hours.

The giant parabolic antenna, built specifically for space tracking, should be able to receive the probe's radio signal at lunar distances and beyond -- possibly up to 400,000 miles from the earth. It is mounted on a 110-foot tower.

The Goldstone facility will funnel tracking and telemetry information back to the computing center at JPL, Pasadena, which will also have data from the earlier tracking phases. Trajectory evaluation will be relayed from the JPL data reduction center to NASA, Washington, D. C.

At the end of its first acquisition period, the Goldstone antenna will lose theprobe for about 14 hours. During this period it will be trained on the horizon point where the probe will re-appear at the end of that time.

After the antenna picks up the probe the second time, it will hold it for another nine to ten hours.

This second acquisition period by Goldstone is a crucial one; during this time the probe should intercept the path of the moon, its closest approach to the moon coming about 34 hours after launch. At this point the moon and probe are over Goldstone.

- END -

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OFFICE OF PUBLIC INFORMATION
1520 H STREET, N. W.
WASHINGTON 25, D. C.
EX. 3-3260 - EXT. 6325

PIONEER IV INFORMATION PLAN

I. Background

II. Policy

III. Responsibilities

IV. Procedures

V. Communications

VI. Release Clearance Policy

<u>Annexes</u>

1. Preplanned Briefings and Announcements
2. Communications
3. Photographic, Film and TV Requirements
4. Contractor Activities

February 28, 1959

FOR OFFICIAL USE ONLY

Pioneer IV Information Plan

1. Background

U. S. public information policy provides for the widest practicable dissemination of information concerning space activities and the results thereof consistent with Federal statute and national security. Within this context, here is a brief review of the moon and space probe series with which this information plan is concerned:

On March 27, 1958, the Advanced Research Projects Agency of the Department of Defense announced a series of five experiments -- three by the Air Force, two by the Army -- designed to obtain data from the vicinity of the moon and beyond.

After the first ARPA-Air Force experiment (August 17, 1958) the remaining experiments were transferred by Executive Order to the National Aeronautics and Space Administration on October 1, 1958. Here is a brief review of the tests carried out to date:

On August 17, 1958, the Air Force Ballistic Missile Division, under ARPA direction, launched the first U.S. moon probe. An engine failure in the first stage of the four-stage Thor Able I rocket caused the vehicle to blow up 77 seconds after lift-off. The probe was not named.

The second test, conducted by AFBMD under NASA direction, took place on October 11, 1958. The probe, christened Pioneer I, traveled 71,300 miles into space and was deemed a qualified success.

The next AFBMD-NASA moon probe attempt ended in failure on November 8, 1958 when the carrier rocket's third stage failed to ignite. This was Pioneer II.

The fourth test was a deep space probe on December 6, 1958 by NASA with the assistance of the Army. A four-stage Juno II rocket propelled a probe 63,580 miles into space. Pioneer III revealed valuable radiation data and, like Pioneer I, was considered a qualified success.

This information plan concerns the fifth and final test in this series planned as part of this country's contribution to the IGY. (There will be later non-IGY moon and space probe attempts.) This test will be conducted by NASA with the assistance of the Army. If the experiment is considered a success, the probe will be named Pioneer IV.

The objectives of this test are similar to those of the December 6 experiment; namely, to achieve an earth-moon trajectory; to probe the physical limits of the Great Radiation Belt (made up of the two so-called Van Allen radiation belts); to determine the extent, if any, of radiation in the vicinity of the moon; and finally, to test a photoelectric sensor which will be activated when it gets within about 20,000 miles of the moon. This device is a prototype for an optical trigger to control picture-taking mechanisms in future space probe experiments. This device, however, does not take pictures of any kind; it simply reacts to the moon's light and reports this fact to earth. (See press kit for details)

II. Policy

While non-security scientific experiments are carried out publicly, certain rules for dissemination of information must be observed. Care should be exercised to assure that the volume of information released is not in excess of that warranted by an experiment's significance or degree of success. There should be an avoidance of competitive publicity efforts regarding space activities that have the object of building up, with the public and the Congress, the agency carrying out the experiment. Finally, space experiments should be stressed as United States efforts.

III. Responsibilities

NASA will conduct this experiment with the assistance of the Army. NASA's Jet Propulsion Laboratory developed the second, third and fourth stages of the Juno II rocket, the scientific payload and prepared trajectory data. The first stage, an Army Jupiter, was developed by the Army Ballistic Missile Agency, Huntsville, Alabama. ABMA is also responsible for assembling and launching Juno II and for carrying out the early tracking phase. JPL directs the long-range tracking phase.

Phase I, Prepositioning

Newsmen will be briefed by the Director of Public Information, NASA, on an off-the-record basis at 2 p.m. on Wednesday, February 25, three days before the scheduled firing time -- 10:13 p.m. on February 28, 1959. The briefing will acquaint newsmen with the nature of the forthcoming experiment, its complexity, and administrative arrangements for press coverage. A similar briefing will be conducted by the Commander of the Atlantic Missile Range at about the same time.

Press kits containing a brief summary of the tests conducted thus far, a description of the launching rocket and the scientific payload will be distributed simultaneously by NASA, Washington, D. C. and by AMR, Cape Canaveral, Fla., on February 27, one day prior to launch.

Press kit material, including photographs, will be marked HOLD FOR RELEASE UNTIL LAUNCHED OR INDEFINITELY DELAYED.

For purposes of this plan, the following definitions and interpretations will apply:

...Launch

A lift-off and firing of all stages, or a lift-off which aborts for any cause, including misfire, failure in flight, or deliberate destruction. If a cutoff occurs prior to lift-off, this would not be considered a launch and the postponement announcement (see below) will be used.

...Hold

A temporary delay in the launching count-down which may extend for several hours. For purposes of this plan, Hold will not extend beyond such time as the assembled press are told to leave the launch site and return the next day.

...Postpone

A delay beyond a Hold period which, for technical or other reasons, will continue up to but not beyond the period scheduled for the experiment. In other words, a postponement will be announced when and if the assembled press are told to leave the launch site and return at a later date. The postponement announcement does not release the press kit material.

...Indefinite Delay

A delay longer than a postponement, requiring a rescheduling of the experiment.

These definitions and conditions will be included in the press kit and will be spelled out at the pre-launch press briefings at AMR and NASA.

Phase II, Launch

This phase includes the time period from two hours before programmed launch until success or failure of same, including the firing of all stages has been determined. During this period, AMR will be prime source of information.

Official confirmation of the launch will be made by NASA -- simultaneously in Washington and at AMR -- using Item C, Annex I, Page 8, within one minute of lift-off.

Official simultaneous confirmation of the firing of the second and third and fourth stages will be made by NASA as soon as technical determination has been made -- probably within about 20 minutes after lift-off. Care will be taken not to apply the term "successful" to the stage firings in the initial hours until data have been carefully analyzed. See Item D, Annex I, Page 8.

Technical failure in the launch phase will be swiftly confirmed by NASA if it occurs within sight of newsmen. If it occurs later in the flight, it will be announced as soon as possible. See Item F, Annex I, Page 9.

NASA will announce postponements simultaneously as indicated (above) in Phase I. See Item G, Annex I, Page 10.

For Indefinite Delay statement, see Item H, Annex I, Page 10.

A brief meeting with newsmen will be held in the press area near the launch site at AMR as soon as practicable after launch or technical failure within the launch phase. Representatives of NASA and ABMA will take part in this meeting. Participants will avoid speculation about the experiment's possible success.

This conference will end with the announcement that all further information about the experiment will emanate from NASA, Washington.

Phase III, Tracking

This phase will be initiated with an NASA press conference in Washington about two to three hours after launch. By this time, "quick look" tracking data will have revealed whether or not the space probe is flying according to plan.

An early position report may be issued by NASA between launch and post-launch press conference.

The Army Ballistic Missile Agency and the U. S. National Committee for the IGY will be represented along with NASA officials on the press conference panel at NASA.

The press conference will produce details of instrumentation, tracking, etc. and a position report of the probe.

This press conference will be transmitted to AMR by telephone for the benefit of the press there who will be able to relay questions to NASA, Washington by teletype or telephone.

Periodic "quick look" progress reports, based upon the analyzed data from JPL, will be posted on a plotting board at NASA. See Items K and M, Annex 1, Pp 13-14 for prepared statements. Progress reports will be made on an after-the-fact basis. Speculation about possible end results of the experiment will be avoided. However, if there is any deviation from the programmed trajectory this will be acknowledged as circumstances dictate.

During the tracking phase, personnel operating the tracking stations will be authorized to acknowledge whether or not they are receiving telemetry signals from the terminal vehicle but will refrain from amplifying such announcements. See Item N, Annex I, Page 15.

The Administrator of NASA will announce the activation of the photoelectric sensor as soon as this has been confirmed -- about 20 hours after launch. See Item O, Annex 1, Page 15.

The tracking phase will terminate with a press conference at NASA when sufficient data are available to present conclusions as to results of the experiment. Again, all interested parties will be represented.

Phase IV Post-Event

All information concerning the scientific results of the experiment will be released by NASA, Washington, D. C. in coordination with the U.S.-IGY organization which will make such findings available to the 66 original participating nations in the IGY programs. (See Annex4 for details of still photographs, television and film coverage of the event.)

Phase V, Communications

A telephone and teletype conference will be established between the Director, Office of Public Information, NASA, and his representative at the Atlantic Missile Range several hours before programmed launch time. The teleconference will be maintained through fourth stage ignition and announcement thereof by NASA. From launch time onward, a telephone and TWX conference will be maintained between NASA and JPL, Pasadena. Commercial telephone will connect NASA and ABMA.

Phase VI, Release Clearance Policy

Prepared statements included in the Annexes to this plan, as well as press kit material, are cleared for release at the times indicated under the conditions described in Section IV, Procedures. All other statements, releases and information must be cleared with NASA.

(See Attached Annexes I thru 4)

PIONEER IV INFORMATION PLAN

ANNEX I

February 25, 1959

ITEM A

Briefing Guide: Prepositioning

A. Introduction:

Plans are underway for the launching of a Juno II rocket containing a space probe similar to the December 6, 1958 experiment. The forthcoming test will be conducted by NASA with the assistance of the U. S. Army. This experiment is the fifth and last of a series of lunar and space probes planned as part of this country's contribution to the International Geophysical Year. (There will be later non-IGY firings.)

The press kits will contain a brief review of the four experiments carried out to date -- three lunar probes and the December 6 space probe.

The purpose of this meeting today is to inform you of the administrative and logistical arrangements which have been made to transmit information about the test to you.

Since considerable information about the program has already been released, there is little need for protracted discussion or question and answer session here today.

B. The following information is off-the-record.

ITEM B

Logistical Briefing for the Press

The news reporting system for the fifth and last test vehicle in the lunar and space probe series planned for the IGY will generally follow the plan used in the December 6, 1958 attempt.

Newsmen are invited to witness the launch at the Atlantic Missile Range. NASA will confirm the launch and staging as it occurs. A press meeting will be arranged at the AMR press site within an hour after successful launch. Representatives of NASA and the Army Ballistic Missile Agency will be present at this meeting.

After the AMR press conference, the source of news will shift to NASA, Washington, D. C. and no further announcements will be provided from Cape Canaveral. ABMA will also be represented at the NASA press conference along with JPL and NASA officials. This conference will be piped to AMR where reporters will be able to relay questions to Washington.

During the remaining tracking phase, raw data will feed from the tracking stations to JPL in Pasadena, thence to NASA headquarters where it will be announced initially. Preliminary tracking information based on "quick look" data will be provided periodically for newsmen.

ITEM C

February 28, 1959

Statement by NASA

Time: T plus about one minute

The United States launched a four-stage experimental space vehicle at the Atlantic Missile Range, Cape Canaveral, Florida at (   ) today.

The launching was accomplished by the National Aeronautics and Space Administration with the assistance of the U. S. Army. It is the fifth and final flight test in a series designed to gather scientific data as part of the U. S. contribution to the International Geophysical Year program. There will be later non-IGY lunar and space probes.

The vehicle is called Juno II. It consists of a Jupiter IRBM as the first stage, or booster, and three upper stages. The vehicle is carrying an instrumented, scientific "payload."

ITEM D

Statement by NASA

Time: T plus about 20 minutes

The second, third and fourth stages of the United States four-stage experimental space vehicle launched at the Atlantic Missile Range, Cape Canaveral, Florida at (   ) today have been fired.

Additional information on the progress of the test will be reported as the data are transmitted to the tracking stations and are, in turn, transmitted to the data reduction center for analysis.

All further information on the remaining phases of this experiment will be released by the National Aeronautics and Space Administration at its Washington, D. C. headquarters.

ITEM E February 28, 1959

Statement by T. Keith Glennan, NASA Administrator

The NASA gave the name Pioneer IV today to the payload of the U. S. space probe, the fifth and last in a series of probes planned as part of the U. S. contribution to the International Geophysical Year.

ITEM F February 28, 1959

Statement by NASA

Time: A few minutes after event occurs

A. An experimental four-stage space vehicle designed to gather scientific data as a part of the U. S. -IGY program exploded on its launch pad at ( ) today at the ATLANTIC MISSILE RANGE, Cape Canaveral, Florida, during an attempted launch. The cause of the technical difficulty will not be determined until all data have been collected and analyzed.

B. An experimental four-stage space vehicle designed to gather scientific data as a part of the U. S. -IGY program (was destroyed) (exploded) at ( ) after (minutes-seconds) of flight today at the ATLANTIC MISSILE RANGE, Cape Canveral, Florida. The cause of the technical difficulty will not be determined until all data have been collected and analyzed.

C. The (second, third, or fourth) stage of an experimental four-stage space vehicle designed to gather scientific data as a part of the U. S. -IGY program (failed to ignite) (exploded) during a launch attempt at ( ) today at the ATLANTIC MISSILE RANGE, Cape Canaveral, Florida. The remaining portions of the vehicle continued upward for a short period of time before falling into the Atlantic Ocean. The cause of the technical difficulty will not be determined until all technical data have been collected and analyzed.

NOTE: These should simply serve as guide lines and do not necessarily have to be duplicated verbatim. There should be some leeway to allow for unexpected action.

ITEM G

Statement by NASA

Test Postponement

Time: As required

Preparations pointing toward an early flight of a U. S. space probe launching vehicle were postponed today at the ATLANTIC MISSILE RANGE. Officials at the range said the postponement was due to ________________________. No information on the next firing date is available.

ITEM H

Statement by NASA

Indefinite Delay

Time: As Required

Preparations for the firing of a U. S. space probe launching vehicle were delayed indefinitely today at the ATLANTIC MISSILE RANGE. Officials at the Range said the indefinite delay was due to ________________________. No information about the next launching date is available.

ITEM I

February 29, 1959

Resume of Launch and Staging

Time: For use at NASA Press Conference at T plus two to three hours

This is a scale model of the Juno II space probe vehicle. It consists of the U. S. Army Jupiter intermediate range ballistic missile as the first or booster stage, and three high-speed upper stages.

The second stage consists of an annular ring of 11 scaled-down, solid propellant Sergeants; the third stage consists of a concentric ring of three scaled-down Sergeants, and the fourth stage consists of a single scaled-down Sergeant. In the upper stages, the configuration is the same as that used by the Army to place three Explorers in orbit.

Before launch, while the Juno II vehicle is still on the pad, the upper stages are set spinning on a rotational launcher built into the Jupiter nose. This is done to provide directional stability in flight. Initially, the vehicle rises vertically, slowly tilting over into its programmed ballistic path. A non-rotating guidance section at the rear of the high speed stages programs the coasting high speed stages into the planned trajectory. A timer inside the rocket ignites the second stage solid propellant rocket cluster.

The third stage ignites after the second stage burns out and falls away and then the fourth stage fires. At four and one half minutes after launch, the 13.40-pound payload separates from the burned out fourth stage and travels at varying speeds on its trajectory to the moon. The payload -- Pioneer IV (of which this is a full scale model) -- continues its flight in space.

ITEM J

Space Probe Instrumentation

(NB: This is an abbreviated version of instrumentation release in press kit.)

The U. S. space probe is a gold-plated, conical instrument package which weighs 13.40 pounds, measures approximately 20 inches in length and is a little more than nine inches in diameter.

Here is a brief description of the instrumentation:

1.) A battery-powered radio transmitter designed to send continuously on a frequency of 960.05 megacycles for about 90 hours -- long after moon-intercept which should come about 34 hours after launch.

The transmitter radiates 180 milliwatts of power.

2.) Two Geiger-Mueller tubes to measure radiation.

Telemetry from the probe's radiation experiment will be broadcast initially during the first five-and-one half hours of flight when it is passing through the Great Radiation Belt (made up of the two so-called Van Allen radiation belts).

After the probe has passed through these intense radiation bands, one of the tubes -- which reports high-level radiation -- will shut off. The other tube will continue functioning and report on moon radiation.

3.) A photoelectric sensor, shaped like a pistol, is mounted on the bottom of the probe at an angle to command a view of the moon as it passes it.

Two small apertures opening into two photoelectric cells are mounted in the barrel of the sensor. The apertures are spaced so that only a comparatively large light image will be wide enough to enter both apertures and trigger both cells, simultaneously. When a light image of sufficient size is encountered, the sensor will report that fact to earth with pulsating signals.

At about 20 hours after launch, when the probe should be about 140,000 miles from the earth, a hydraulic timer will arm the sensor's memory device which will report subsequent light images. At that point, the earth will offer too small an image to activate both cells, and the only object capable of doing so will be the moon. The sensor experiment will provide a test for a trigger device which could be used to activate picture-taking mechanisms in future space experiments, but this sensor will not produce pictures of any kind.

4.) The de-spin mechanism is an important element in the experiment. The upper stages of Juno II are spin-stabilized before and during launch so that the probe in space continues to rotate on its long axis at approximately 600 revolutions per minute. At this speed, the sensor data would be meaningless, so a method had to be found to slow the spin rate down after the probe is in space. The answer was found to be a simple application of an elementary principle of physics. Two small weights, about seven grams each, are fastened to the payload at the ends of wires 60 inches long. During and after launch, the wires and weights are wrapped around the payload and are secured in place. At about 10 hours after launch, a hydraulic timer will free the weights and centrifugal force will make them spin with the payload at the ends of their wires. After a few revolutions, they will be released to fly off into space. This will be enough, however, to cause the payload to slow down to about nine revolutions per minute in one quarter of a second.

ITEM K February 28-29, 1959

Proposed NASA Statement

Post-launch NASA press conference at T plus two to three hours

At ____________(E.S.T.), Pioneer IV, the United States space probe, was ____________ latitude, ____________longitude and was ______ statute miles above the surface of the earth.

This is an approximate position determined as a result of "quick look" data analysis and is subject to change.

ITEM L

Tracking Station Schedules

Time: This is an abbreviated version of a release which will be included in the press kit on a Hold for Release Until Launched or Indefinitely Delayed basis.

The tracking of the U.S. space probe to be launched by a Juno II rocket consists of two principal phases -- powered flight and space flight.

The U.S. Army Ballistic Missile Agency, Huntsville, Ala., (an agency of the Army Ordnance Missile Command) is charged with the first phase. NASA's Jet Propulsion Laboratory at California Institute of Technology, Pasadena, Calif., is responsible for the second phase.

The first phase ends about four-and-one half minutes after launch when -- all stages having fired -- propulsion ceases and the probe becomes a body moving on a trajectory through space.

During the initial period, Army tracking stations at Cape Canaveral and Miami, Fla., Fort Stewart, Ga., and the Ballistic Research Laboratory, Aberdeen, Md., follow the probe. The date are fed directly into the Computations Laboratory at ABMA, Huntsville, where they are reduced and fed into a computer.

The computer then determines the payload velocity; the vector angle (angle at which the payload is travelling with relation to the earth's surface) and the relation of the actual flight path to the planned flight path. These data are sent to JPL, Pasadena.

The second phase begins between about four and five minutes after launch when a 10-foot diameter JPL tracking antenna at Mayaguez, Puerto Rico, picks up the probe and holds it for the next five or six hours by which time the probe should have traveled about 50,000 miles -- the limit of its tracking capacity.

Before Puerto Rico has lost the probe below its horizon, JPL's 85-foot diameter space tracking radio telescope at Goldstone Dry Lake in Camp Irwin, Calif., will acquire the signal and lock onto it for the next nine to ten hours.

The giant parabolic antenna, built specifically for space tracking, should be able to receive the probe's radio signal at lunar distances and beyond -- possibly up to 400,000 miles from the earth. It is mounted on a 110-foot tower.

The Goldstone facility will funnel tracking and telemetry information back to the computing center at JPL, Pasadena, which will also have data from the earlier tracking phases. Trajectory evaluation will be relayed from the JPL data reduction center to NASA, Washington, D. C.

At the end of its first acquisition period, the Goldstone antenna will lose the probe for about 14 hours. During this period it will be trained on the horizon point where the probe will reappear at the end of that time.

After the antenna picks up the probe the second time, it will hold it for another nine to ten hours.

This second acquisition period by Goldstone is a crucial one; during this time the probe should intercept the path of the moon, its closest approach to the moon coming about 34 hours after launch. At this point the moon and probe are over Goldstone.

ITEM M

Position Report

Time: T plus six hours or later

The position of the U. S. space probe, Pioneer IV, at _______ E.S.T. was ___________ latitude __________ longitude and was __________ miles above the surface of the earth.

Pioneer IV's radio transmitter is functioning properly (and it is proceeding approximately on programmed course through space or (and it has deviated from pre-planned trajectory -- with explanation).

ITEM N

Tracking Station Announcements

Time: T plus about three hours

1.) Affirmative Statement:

"I am receiving signals from the U. S. Pioneer IV Space Probe. I am tracking it now. I am not able to give more information because the telemetry data I have are in the raw state and must be analyzed before they become meaningful."

2.) Negative Statements:

(1) "I am not receiving signals from the U. S. Pioneer IV Space Probe. I do not expect to be receiving at this time."

(2) "I am not receiving signals from the U. S. Pioneer IV Space Probe. I am now inspecting and checking my equipment to find out why."

ITEM O

February ___, 1959

Activation of Photoelectric Sensor

Release at about T plus 20 hours

The photoelectric sensing device in Pioneer IV was sucessfully activated by a hydraulic timer at T plus 20 hours, at which time the speeding probe was 140,000 miles from the earth.

The photoelectric sensor, mounted on the bottom of the probe at an angle commanding a view of the moon as the probe moves beyond it, will start to send radio signals in the form of audible pulsations when the probe is within 22,000 miles of the moon. It will continue to send back information until it is on the far side of the moon on its way out into space.

The sensing device, activated by the light received through two apertures in the pistol-shaped mounting on the bottom of the probe, provides information on proximity of Pioneer IV to the moon. This device is a prototype for an optical trigger which might be used to control picture-taking mechanisms in future space probe experiments. This mechanism, however, does not take pictures of any kind.

ITEM P

February ___, 1959

Time: T plus 33 hours

Proposed NASA-IGY Announcement

Project scientists have reported that Pioneer IV is now in orbit around the sun. It is too early to state the precise path of the orbit, but telemetry received by tracking stations indicates that the performance of the photoelectric sensor, as well as the position, velocity and direction of Pioneer IV at the time of firing, assures achievement of a satisfactory orbit.

Alternate statement if above not confirmed

Project scientists have reported that the Pioneer IV is continuing to return telemetry data to tracking stations. Its psotion is (if known).

PIONEER IV INFORMATION PLAN

ANNEX 2

COMMUNICATIONS:

1. This plan will be supported by continuous communications between the sites of the test activity and sources of evaluation and information.

2. In essence, the communications network required for this project will consist of two major integrated nets. Each have a specific purpose as follows:

A. The Army-NASA Tracking Network:

(See Item L)

B. Public Information Network:

This network provides direct telephone and teletype communications between NASA, Washington, D. C. and AMR, Florida; telephone and TWX communications between NASA, Washington and JPL, Pasadena; and commercial telephone between NASA, Washington and ABMA, Huntsville, Ala. (See Phase V, for details).

PIONEER IV INFORMATION PLAN

ANNEX 3

Pictorial, Radio and TV Requirements

1.) Motion Picture Film Coverage:

Motion picture stock footage of pre-launch and launch activities will be programmed by Walter Hering, NASA Photographic Coordinator, Atlantic Missile Range.

Responsibility for accomplishing motion picture film coverage:

The RCA film group at the Atlantic Missile Range will accomplish the film coverage in 35mm black and white and color 16mm color for pre-launch and launch activities.

Processing and disposition of motion picture film footage:

The pre-launch footage will be released to the national TV and newsreel pool members on a hold for release until launched or indefinitely delayed basis, via Defense Department processing and and security review. The launch footage will be flown to Washington by the Air Force and released to the national TV and newsreel pool members.

2.) 28-Minute National release film on Probe

The film section of JPL is preparing a 28-minute motion picture in color and sound. This film will include a history of the Juno projects as well as photography of the scheduled February 28 launch. This film will be given national release in the weeks after the launch.

A 20-minute, edited version of this film (deleting footage of the launch) in black and white will be released to the television and newsreel pool members on a hold for release until launched or indefinitely delayed basis on February 24, 1959.

3.) TV-Radio Coverage:

TV coverage at AMR will be accomplished on a pool basis by the pool member designated. This coverage may be released upon launch according to the definitions established previously in this plan.

Post-launch announcements and press briefing will be covered by radio-TV at NASA, Washington. This coverage may be live and will not be pooled. It will also be available to motion picture newsreels. Liaison with radio and TV at NASA, Washington will be provided by Dick Mittauer.

PIONEER IV INFORMATION PLAN

ANNEX 4

February 28, 1959

I. Policy:

Civilian contractors participating in the development, manufacture or test of equipment used in the space probe experiment, and with the conduct of the experiment itself, will be given appropriate public recognition. Contractors will be authorized to conduct advertising and public relations activities in support of the program, within the limitations of NASA regulations and subject to the clearance and approval in advance by NASA through normal operating channels. This release will not be made earlier than determination of a successful launch and trajectory between two to three hours after launch.

II. Procedure:

A. Principal point of contact for information for all contractors participating in the space probe experiment will be NASA, Washington (Paul Haney).

B. Upon approval of this plan NASA will provide implementing instructions to all contractors.

C. Companies participating in the experiments will be authorized to prepare and submit for clearance brief releases describing the company's participation in the program and 8 x 10 glossy photographs with negatives of the item or activity with which the company is concerned. When cleared through NASA, this material will be incorporated in a "Contractor Press Kit" to be released after a successful launch at NASA, Washington and AMR.

D. Participating companies will be authorized to prepare hometown releases on members of their organizations directly involved in development, manufacture and test of equipment and the conduct of the experiments. These releases may take either written or audio-visual form. Releases will be submitted to NASA, for review and clearance prior to release.

E. Institutional advertising, giving recognition to the program and to the contractors' participation therein may be prepared ahead of time by contractors for release after determination of a successful launch and trajectory. Proposed advertisements will be submitted to NASA for review prior to release.

- END -

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

BACKGROUND FOR EDITORS

EX 3-3260
Ext. 7834

FOR RELEASE: Thursday, P.M.
February 19, 1959

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PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Support of JPL plant	HS-41	Conduct of Research	JPL (California Tech.)	8,160,000	$8,160,000
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Research contracts	NASW-21	Molecular Study	Yale University	110,000	110,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE Sounding Rockets	HS-47	Partial support of Space Sciences Division (Townsend) (see also "Earth satellites")	NRL (ONR-Navy)	1,900,000	1,900,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Earth Satellites	HS-6	Earth Satellites (including Thor-Able boosters)	BMD (ARDC-Air Force)	7,120,000	7,120,000
	HS-21	Juno II boosters	AOMC (Army)	8,540,000	8,540,000
	HS-37	Computing services (60%) (see also "Lunar Probes" and "Deep-Space Probes"	Bureau of Standards (Commerce)	80,000	80,000
	NASW-20	Alterations to buildings 5-7 Bellevue Annex	Alton Engineering Co.	130,000	130,000
	HS-47	Partial support of Space Sciences Division (Townsend) (see also "Sounding rockets")	NRL (ONR-Navy)	2,000,000	2,000,000
	HS-48	Research on rubidium frequency standards	Bureau of Standards (Commerce)	270,000	270,000
	NASW-17	Reduction analysis (see also "Deep-space probes")	Iowa State University	10,000	19,320

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of Contract
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Lunar Probes					
	HS-1	Lunar probe projects	AOMC (Army)	2.11	$2,600,000
	HS-2	Lunar probe projects	BMD (ARDC-Air Force)	2.00	2,000,000
	HS-3	Lunar probe projects	NDTS (ONR-Navy)	$200,000	200,000
	HS-37	Computing services (30%) (see also "Earth satellites" and "Deep-space probes")	Bureau of Standards (Commerce)	40,000	40,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Deep Space probes					
	HS-5	Space probes	BMD (ARDC-Air Force)	8,990,000	8,990,000
	HS-20	Deep-space study	ABMA (Army)	340,000	340,000
	NASW-6	Deep-space study	JPL (California Tech.)	1,300,000	1,300,000
	HS-37	Computing services (10%) (see also "Earth satellites" and "Lunar probes)	Bureau of Standards (Commerce)	10,000	10,000
	HS-40	Construction of addition to building No. 125 at JPL	Corps of Engineers (Army)	150,000	150,000
	NASW-17	Space probe instrumentation (see also "Earth satellites")	Iowa State University	40,000	292,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Vanguard division	HS-23	Support of the Vanguard Division, Space Projects Center	NRL (ONR-Navy)	23,500,000	23,500,000
PROGRAM: SATELLITE APPLICATIONS INVESTIGATIONS: Communications	HS-4	100 ft. inflatable sphere	AOMC (Army)	2,150,000	2,150,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: High-energy fuel rockets	HS-13	"State-of-art" work on rocket engines	WADC (ARDC-Air Force)	430,000	430,000
	NASW-6	Develop 6,000 lb. thrust storable propellant system	JPL (California Tech.)	2,000,000	3,400,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: 1-million pound thrust single chamber engine	HS-10	1,000,000 pound thrust rocket engine	Rocketdyne Division of North American Aviation, Inc.	10,000,000	102,000,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: Nuclear rocket engines	HS-15	Rover Program	A.E.C.	1,900,000	1,900,000
PROGRAM: SUPPORTING ACTIVITIES: Tracking and data acquisition	NASW-7	Operation of earth satellite radio tracking and receiving stations for 6 months beginning 1/1/59	Government of Peru	75,000	75,000

ACTIVITY: LANGLEY RESEARCH CENTER

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Support of NASA plant	NA1-3679	Modification of the impact basin to provide working space for Space Projects Center personnel	Endebrock-White Company	60,000	60,000

ACTIVITY: SPACE PROJECTS CENTER (LEWIS)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	NAS3-305	Furnishing Automatic Flight Control Systems	Minneapolis-Honeywell Regulator Co.	140,000	140,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY High-energy fuel rockets	NAS3-262	Propellant Tank Assemblies	Douglas Aircraft Co.	110,000	110,000
	NAS3-234	Furnishing rocket thrust chambers and necessary tooling	Solar Aircraft Co.	180,000	180,000

ACTIVITY: SPACE PROJECTS CENTER (LANGLEY)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	S-1000(G)	X-248 rockets	Bureau of Ordnance (Navy)	100,000	100,000
	S-1010(G)	X-254 rockets	Bureau of Ordnance (Navy)	1,120,000	1,120,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	NAS-5-53	Jupiter seniors	Bureau of Aeronautics (Navy)	1,020,000	1,020,000
	S-1013(G)	XM-45 rockets (see also "Manned space Flight")	ABMA (Chief of Ordnance, Army)	90,000	90,000
	L-55,931 (G)	TX-33-20 rockets (see also "Manned space flight")	ABM (Chief of Ordnance, Army)	620,000	620,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	HS-24	Atlas D boosters	BMD (AIR FORCE)	1.40	*________
	HS-36	Atlas D boosters	BMD (AIR FORCE)	5.60	*________
	S-1013(G)	XM-45 rockets (see also "Earth satellites")	ABMA (Chief of Ordnance, Army)	120,000	120,000
	NAS5-51	Booster hardware, sets for TX-33	Aerolab Development Co.	70,000	70,000
	NAS5-55	XM-19E1 rockets	Thiokol, Inc.	110,000	110,000
	L-55,931 (G)	TX-33-20 rockets, TX-33-22 rockets (see also "Earth satellites")	ABM (Chief of Ordnance, Army)	2,200,000	2,200,000
	HS-44	Part of Redstone boosters	AOMC (Army)	4,490,000	15,500,000
	NAS5-57	Transport vehicles and launcher (S-91-4)	North American Aviation Missile Division	400,000	400,000
	HS-54	Jupiter boosters	AOMC (Army)	2,740,000	4,450,000

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	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of Contract
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	HS-32	Tracking and data reduction services	Smithsonian Institu-tion	470,000	2,500,000

* Total amount of contract still under negotiation.

ACTIVITY: LANGLEY RESEARCH CENTER

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Support of NASA plant	NA1-3679	Modification of the impact basin to provide working space for Space Projects Center personnel	Endebrock-White Company	60,000	60,000

ACTIVITY: SPACE PROJECTS CENTER (LEWIS)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	NAS3-305	Furnishing Automatic Flight Control Systems	Minneapolis-Honeywell Regulator Co.	140,000	140,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY High-energy fuel rockets	NAS3-262	Propellant Tank Assemblies	Douglas Aircraft Co.	110,000	110,000
	NAS3-234	Furnishing rocket thrust chambers and necessary tooling	Solar Aircraft Co.	180,000	180,000

ACTIVITY: SPACE PROJECTS CENTER (LANGLEY)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	S-1000(G)	X-248 rockets	Bureau of Ordnance (Navy)	100,000	100,000
	S-1010(G)	X-254 rockets	Bureau of Ordnance (Navy)	1,120,000	1,120,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	NAS-5-53	Jupiter seniors	Bureau of Aeronautics (Navy)	1,020,000	1,020,000
	S-1013(G)	XM-45 rockets (see also "Manned space Flight")	ABMA (Chief of Ordnance, Army)	90,000	90,000
	L-55,931 (G)	TX-33-20 rockets (see also "Manned space flight")	ABM (Chief of Ordnance, Army)	620,000	620,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	HS-24	Atlas D boosters	BMD (AIR FORCE)	1.40	*________
	HS-36	Atlas D boosters	BMD (AIR FORCE)	5.60	*________
	S-1013(G)	XM-45 rockets (see also "Earth satellites")	ABMA (Chief of Ordnance, Army)	120,000	120,000
	NAS5-51	Booster hardware, sets for TX-33	Aerolab Development Co.	70,000	70,000
	NAS5-55	XM-19E1 rockets	Thiokol, Inc.	110,000	110,000
	L-55,931 (G)	TX-33-20 rockets, TX-33-22 rockets (see also "Earth satellites")	ABM (Chief of Ordnance, Army)	2,200,000	2,200,000
	HS-44	Part of Redstone boosters	AOMC (Army)	4,490,000	15,500,000
	NAS5-57	Transport vehicles and launcher (S-91-4)	North American Aviation Missile Division	400,000	400,000
	HS-54	Jupiter boosters	AOMC (Army)	2,740,000	4,450,000

*Total amount of contract still under negotiation

RESEARCH AND DEVELOPMENT OPPORTUNITIES FOR INDUSTRY IN SPACE*

By Albert F. Siepert, Director of Business Administration
National Aeronautics and Space Administration

The invitation of Congressman Becker for the National Aeronautics and Space Administration to appear before this Conference is very much appreciated. It was to Dr. Glennan's regret that he found that an appropriation hearing requires him to remain in Washington, but he asked me to extend his greetings to this Conference.

The National Aeronautics and Space Administration -- or NASA as we have come to abbreviate it -- came into effective operation last October 1st or only four-and-a-half months ago. It was established by the Space Act of 1958 which the President signed into law on July 29th.

This was the first permanent statute in which the Congress set out explicitly the importance to our nation of activities in outer space. It resulted from a Special Message to Congress submitted by the President on April 2, 1958.

In his message, the President recommended establishment of a civilian space agency with power to conduct research projects within its own facilities or by contract with other organizations. It would be free, said the President, "to enlist the skills and resources required for the space program wherever they may be found, and to do so under the arrangements most satisfactory to all concerned." And the ultimate purpose of such efforts is to achieve for the United States a world leadership in all aeronautical and space research enterprises. This is no easy objective as most Americans realize when they uneasily observe the success of the present Russian Sputniks and Luniks -- these Soviet payoffs have resulted

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*Delivered before the Nassau-Suffolk Industrial Procurement Conference, Garden City Hotel, Garden City, Long Island, New York, February 19, 1959 from some four to five years' head start in developing rockets of greater payload capability than we have today.

When NASA began last October, our Administrator, Dr. Glennan, made clear that the agency would operate with the same sense of urgency as in time of war. In short, we have had to get into the space business fast -- organizing new efforts with one hand and operating existing projects with the other in a manner which assures that the advent of NASA will accelerate rather than retard this vital business of catching the Russians in the space race.

As a new agency NASA could have been started from scratch -- building and equipping new facilities and then undertaking to staff them with the necessary scientists and engineers. But this would have been an expensive, and most importantly, a time consuming process. It would require the dislocation of staff already working in the space field in other government organizations, private research firms, and industry. The Congress determined upon a better course -- provide broad authority to build the new civilian space effort upon facilities already doing outstanding work in NASA's field.

Under the Space Act, NASA acquired the entire functions, property and personnel of the National Advisory Committee for Aeronautics which then ceased to exist. Created in 1915, the NACA had developed for the United States a leadership, recognized world-wide, for fundamental progress in practically every field of aeronautics research and development.

From the NACA, NASA has inherited a staff of 8,000 personnel with highly developed skills in both aeronautics and outer space research, and it took over a unique set of research laboratories with an original total cost of around $350 million -- at Langley in Virginia, at Ames near Palo Alto, California, at the Lewis Research Center near Cleveland the High Speed Flight Station at Edwards, California, and a Rocket Research Station at Wallops Island on the eastern shore of Virginia.

In addition, the President has twice exercised authority granted in the Space Act to transfer to NASA functions and facilities which primarily relate to its responsibilities. On October 1st, and without changing DOD's responsibility for space projects which are primarily concerned with weapons systems or military uses, the President transferred to NASA a series of other non-military space programs of the Department of Defense -- such as the Pioneer deep space probes, the Explorer lunar probes, several forthcoming scientific satellites, and other space-related projects particularly in the field of high-thrust propulsion systems. In this same transfer, Project Vanguard was also shifted from the Navy to NASA direction. We are understandably pleased that the first Vanguard firing since this transfer went so successfully this last Tuesday.

Secondly, in early December 1958, President Eisenhower transferred to NASA the facilities of the Jet Propulsion Laboratory at Pasadena, California, from the Department of the Army. This is a 2300 man organization which has shown great technical capability in developing JATO, the Corporal and Sargeant missiles, and the upper stages and payload of the successful Explorer satellites. Although the Laboratory is operated by the California Institute of Technology under NASA, the facilities at Pasadena are government owned.

Lastly, arrangements have been made with the several Armed Services to use their facilities or special skills, such as the Army's ABMA at

Huntsville, Alabama, whenever these can meet NASA's requirements without interfering with their military mission.

One of the significant changes in NASA's program, as contrasted with its NACA predecessor, was a major increase in budget. Last year NACA had an entirely in-house research and development program of about $100,000,000 The first year program for NASA is at a level of slightly more than $300 million, including some $154 million transferred with the DOD space projects and $80 million in funds for new space efforts. A supplemental 1959 budget request for $48 million is pending before the Congress. The President's proposed budget for Fiscal Year 1960 earmarks $485,300,000 for NASA. The biggest share of these funds is intended for research and development contracts outside Government. In total, these estimates provide contract funds approximating $220 million in 1959 and $330 million in 1960.

Contracting with industry on this scale is a quite different type of procurement than that which fulfilled the needs of the old NACA. Its several research centers have always been buying a great variety of parts, instruments, and supplies for use in developing and testing its own research ideas; however, very seldom did it engage in research-type cost reimbursement contracts with industry. But the new mission for NASA in space requires that we tap the highest ingenuity of American university science and industrial "know-how" as well as our own capabilities within government laboratories. We need these skills in order to develop and produce larger rocket boosters, more reliable guidance, control, and communications systems, still more dependable payload instrumentation -- in fact, entirely new generations of space vehicles which have a far greater capability for exploration and use of outer space than anything we -- or the Russians -- have today.

Our plans and policies for managing this procurement intend to take full advantage of the unusual status the Congress has given the national space program. By its enactment of a special Space Act, it has created NASA as an independent agency rather than a bureau or service within a Cabinet Department. The law provides a well-defined, straight line mission with a wide degree of authority to administer the program with a flexibility to meet unexpected problems. For example, the Space Act provides NASA practically all the procurement powers of the military services by making the Armed Services Procurement Act applicable to NASA. Yet the relative smallness of our budget compared to the defense procurements, and the consequent smallness and simplicity in the organization we use to administer the program give us opportunities to use our procurement authority in moving quickly to resolve technical and policy considerations which affect our contractor relationships. Our independent status and the fact that NASA will operate under its own procurement regulations will not, however, result in a "new system" which industry would need to learn in dealing with us. One of the first announcements made by the Administrator after NASA was established was to the effect that NASA's contracting and procurement procedures would conform as nearly as practicable with the Armed Services Procurement Act and its subsequent regulations.

At the time of that announcement, Dr. Glennan said, (quote) "This decision should be welcomed by potential NASA contractors since industry has become quite familiar with the Armed Services Procurement Regulations in the past ten years. They will not be required to learn how to operate under widely divergent NASA regulations, nor will this change procedures for those contractors now engaged in projects which have recently been transferred from the Department of Defense to NASA." (unquote) Should NASA modify procedures from those contained in the ASPR, it will do so only when the change is clearly necessary to facilitate the NASA mission.

The differences between our procurement and DOD's relate primarily to our not engaging in large-scale production contracts as the aftermath of our research and development contracts. Each space experiment has specifications for a high degree of individual design and relatively little mass assembly work. Consequently, I must repeat that relatively speaking, the aggregate NASA budget is likely to be small in comparison with the hardware budgets of any of the military services.

Along these lines, we might briefly examine some conclusions reached recently by Dr. Homer J. Stewart, formerly of CalTech and now Director of NASA's Office of Program Planning and Evaluation. In assessing what type of industry will be required to carry out the nation's space program for the next decade or so, Dr. Stewart reached two major conclusions.

The first is that the industry will not be heavy industry, in either the sense that vast quantities of raw materials will be consumed or that a large variety of individual end-items will be required. He points out that even the military requirements for ballistic missiles do not require a substantial fraction of the industrial capacity of the nation for production. And in numbers, there will be fewer space vehicles required than military rockets.

A second conclusion reached by Dr. Stewart is that a major part of the industry associated with the national space effort will consist of highly specialized electronic and instrumentation groups. This is because payload costs may become as large or even larger than the basic vehicle costs. The technical qualities of the work will be extremely far advanced with production more likely in the dozens than in the hundreds.

"In summary", Dr. Stewart concludes, "the indications of the industrial trends which will be required to support our space activities lie very much along the same line as the modifications to industry which have been required by our modern weapons industry and by our nuclear industry. The work will provide fascinating and challenging engineering problems for many years to come."

Of the $220 million to be available for procurement in 1959, the great bulk of this is now programmed and more than half of it has been obligated by contract. Looking at the current program as well as the $333 million requested for 1960, it is clear that the main effort will be concentrated in two broad fields. Approximately 20% of the money will be devoted to space propulsion technology, including the development of solid fuel rockets, high energy fuel rockets, the one and one-half million pound single chamber nuclear rocket engine development, and auxiliary power units to be used in payloads. Approximately 50% will be devoted to the procurement of vehicles and instruments, or scientific investigations in space which cover sounding rockets, earth satellites, lunar probes and deep space probes of various kinds. Another 20% will be devoted to developing our technology for manned space flight, including the construction of our first manned space capsule under Project Mercury. Approximately 6% will go into specific investigations of satellite applications in the field of meteorology and communication. The balance of the funds are proposed for contracts in tracking and data acquisition, and in advanced space technology such as the development of new type vehicle systems, methods of recovering boosters, and broadly supported research in space science either in universities or in contract with the government owned Jet Propulsion Laboratory operated by the California Institute of Technology.

We believe that all of these fields play an essential part in the development of a national space program with a lasting payoff. It behooves both our technical and procurement people to organize the program and negotiate contracts with dispatch. Several research and development contracts already awarded industry indicate the speed and urgency with which NASA will seek to do this job. One of the largest long-term contracts has already been completed involving a $10 million initial contract with Rocketdyne Division of North American Aviation for a single chamber rocket engine to produce a thrust of one to one-and-a-half million pounds. This engine, a four or more year development at an estimated total cost of some $200 million, is most urgently needed as the basic workhorse for lifting into space the large payloads envisioned for the near future.

It will be of interest to this group that the definitive contract was signed and work actually put underway on January 10, 1959. This was within eleven weeks from the first invitation for proposals to the signing of the final contract. Within this period companies were given one month to develop their proposals and six companies participated in the competition. In addition, technical evaluations were completed by NASA, the source was selected, the proposed "boilerplate" contract provisions were provided Rocketdyne for a week of review, and a definitive contract, including the fixed fee determination were completed. As a matter of fact, the formal contract negotiations were consumated within one week. The top priority in NASA's program is Project Mercury, the development of a space capsule in which man will orbit into space and return safely. Here, as in all our contracting, we sought to obtain widespread competition from industry and asked for proposals from 34 firms on November 17th. Twelve firms submitted responsive bids on December 17. The technical evaluation, the source selection, the fee determination, and the other details of contract negotiation were handled with dispatch so that the contract was signed with McDonnell Aircraft Corporation of St. Louis, Missouri, on February 5th -- again a time lapse of less than three months.

In both of these cases, NASA elected not to issue a letter of intent. It was felt that a definitive contract could be negotiated with no loss of time if both parties put top priority on the task. Experience in each of these cases bore out this expectation and justified the procedure which was followed. The management of both companies have expressed their pleasure to NASA in the speed with which a definite contract was concluded.

Both of these contracts were negotiated cost-plus-fixed-fee contracts. So far as their terms and conditions are concerned, they are substantially the same as would be the case if they had been made with one of the military departments.

Our plans for the administration of NASA contracts contemplate a considerable reliance upon the assistance of the established services maintained by the Department of Defense. In the majority of cases NASA contracts for research and development will constitute a minority of the total government business in work with a given contractor. Wherever practicable NASA will ask the military service with the preponderant business in the plant at the time to undertake for NASA the functions of contracting officer representative. It will also seek to have the cognizant government agency handle the audit so that the contractor is not involved in two separate discussions as to the allocation of his overhead to the actual costs of the various government contracts. Finally, NASA will provide its own scientific and technical liaison representatives to work directly with the technical and engineering staff of the contractor.

Perhaps I should mention that there will be a few differences in our procedures which we hope all contractors will understand. In the field of patents there is specific language in the Space Act requiring NASA to take title for the government to certain inventions made in the performance of its contracts. The Administrator has authority to waive such rights where his action is clearly within the public interest. As you know, the Department of Defense is under no legal restriction in this respect and, as a matter of policy, only requires a royalty free license in a typical research and development situation. This difference in the legal restrictions between two main contracting agencies can lead to confusion when the government deals with the same segments of industry and substantially the same kind of business. NASA, however, will make every effort to administer its legal requirement concerning patents fairly and objectively with due consideration to the interests of both government and private industry.

At the moment the Defense Department has authority, which NASA is seeking, to insure research and development contractors against property damage or loss, and against liability to third persons arising from risks defined by the contract as unusually hazardous. As a matter of fact, both NASA and DOD have pending legislative proposals which would authorize both agencies to exercise indemnification authority in all types of procurement rather than research and development alone. At the moment NASA is not one of the agencies authorized to extend V-loan authority to guarantee financing of loans to government contractors. NASA proposes to have this corrected by issuance of an Executive Order.

Although NASA by law is a civilian agency, it has priorities and allocation authority under the Defense Production Act. The Space Act also places specific responsibility on NASA to develop suitable methods which will enable small business to the maximum practicable extent to participate equitably in the conduct of the work of the Administration to the end that our procurement staffing will make specific provision for this function.

I am sure all of you realize that the development of a procurement program is never easy. It is never a simple thing to do business with the government because an incredible number of safeguards with good reason have been built into the process in order to protect the public interest, and assure a maximum of competition without favor. It is the intention of NASA to give full regard to the safeguards without impairing our over-all effectiveness and efficiency in dealing with industry in the accomplishment of our space mission. We will seek whatever legal authority is necessary to accomplish that aim.

A government agency has one of its widest areas of contact with the public through its procurement program. Industry as the prime contact in this area, should expect fair efficient dealing in the procurement process. I believe NASA has begun its procurement program by demonstrating its intention to fulfill this expectation. We hope to continue to show industry and the public that NASA is an effective and efficient custodian of responsibility in directing the United States' civilian aeronautical and space activities.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7834

BACKGROUND FOR EDITORS
FOR RELEASE: Thursday, P.M.
February 19, 1959

NASA RESEARCH AND DEVELOPMENT CONTRACTS

Attached is a contract-by-contract breakdown of NASA Research and Development contracts from the beginning of NASA -- October 1, 1958 -- through January 31, 1959.

In the future, NASA plans to release contract information on a monthly basis.

In several instances in this R and D breakdown, the "total amount of contract" figure covers a period of several years. Thus it represents a working estimate of what the total will be.

ACTIVITY: NASA HEADQUARTERS

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of Contract
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Support of JPL plant	HS-41	Conduct of Research	JPL (California Tech.)	8,160,000	$8,160,000
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Research contracts	NASW-21	Molecular Study	Yale University	110,000	110,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE Sounding Rockets	HS-47	Partial support of Space Sciences Division (Townsend) (see also "Earth satellites")	NRL (ONR-Navy)	1,900,000	1,900,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Earth Satellites	HS-6	Earth Satellites (including Thor-Able boosters)	BMD (ARDC-Air Force)	7,120,000	7,120,000
	HS-21	Juno II boosters	AOMC (Army)	8,540,000	8,540,000
	HS-37	Computing services (50%) (see also "Lunar Probes" and "Deep-Space Probes"	Bureau of Standards (Commerce)	80,000	80,000
	NASW-20	Alterations to buildings 5-7 Bellevue Annex	Alton Engineering Co.	130,000	130,000
	HS-47	Partial support of Space Sciences Division (Townsend) (see also "Sounding rockets")	NRL (ONR-Navy)	2,000,000	2,000,000
	HS-48	Research on rubidium frequency standards	Bureau of Standards (Commerce)	270,000	270,000
	NASW-17	Reduction analysis (see also "Deep-space probes")	Iowa State University	10,000	19,320

Program	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of Contract
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Lunar Probes	HS-1	Lunar probe projects	AOMC (Army)	2,110,000	$2,600,000
	HS-2	Lunar probe projects	BMD (ARDC-Air Force)	2,000,000	2,000,000
	HS-3	Lunar probe projects	NDTS (ONR-Navy)	$200,000	200,000
	HS-37	Computing services (30%) (see also "Earth satellites" and "Deep-space probes")	Bureau of Standards (Commerce)	40,000	40,000
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Deep Space probes	HS-5	Space probes	BMD (ARDC-Air Force)	8,990,000	8,990,000
	HS-20	Deep-space study	ABMA (Army)	340,000	340,000
	NASW-6	Deep-space study	JPL (California Tech.)	1,300,000	1,300,000
	HS-37	Computing services (10%) (see also "Earth satellites" and "Lunar probes)	Bureau of Standards (Commerce)	10,000	10,000
	HS-40	Construction of addition to building No. 125 at JPL	Corps of Engineers (Army)	150,000	150,000
	NASW-17	Space probe instrumentation (see also "Earth satellites")	Iowa State University	40,000	292,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATIONS IN SPACE: Vanguard division	HS-23	Support of the Vanguard Division, Space Projects Center	NRL (ONR-Navy)	23,500,000	23,500,000
PROGRAM: SATELLITE APPLICATIONS INVESTIGATIONS: Communications	HS-4	100 ft. inflatable sphere	AOMC (Army)	2,150,000	2,150,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: High-energy fuel rockets	HS-13	"State-of-art" work on rocket engines	WADC (ARDC-Air Force)	430,000	430,000
	NASW-6	Develop 6,000 lb. thrust storable propellant system	JPL (California Tech.)	2,000,000	3,400,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: 1-million pound thrust single chamber engine	HS-10	1,000,000 pound thrust rocket engine	Rocketdyne Division of North American Aviation, Inc.	10,000,000	102,000,000
PROGRAM: SPACE PROPULSION TECHNOLOGY: Nuclear rocket engines	HS-15	Rover Program	A.E.C.	1,900,000	1,900,000
PROGRAM: SUPPORTING ACTIVITIES: Tracking and data acquisition	NASW-7	Operation of earth satellite radio tracking and receiving stations for 6 months beginning 1/1/59	Government of Peru	75,000	75,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SUPPORTING ACTIVITIES: Tracking and data acquisition	NASW-19	Operation of 2 earth satellite tracking and receiving stations beginning 1/1/59	University of Chile	80,000	80,000
	NASW-11	Operations of Minitrack stations in South America and Cuba for 18 months beginning 1/1/59	Bendix Radio Corp.	600,000	*
	HS-22	Photo reduction equipment	Smithsonian Astrophysics Laboratory	120,000	120,000
	HS-32	Tracking and data reduction services	Smithsonian Institution	470,000	2,500,000

* Total amount of contract still under negotiation.

ACTIVITY: LANGLEY RESEARCH CENTER

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: AIRCRAFT, MISSILE, AND SPACECRAFT RESEARCH Support of NASA plant	NA1-3679	Modification of the impact basin to provide working space for Space Projects Center personnel	Endebrock-White Company	60,000	60,000

ACTIVITY: SPACE PROJECTS CENTER (LEWIS)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	NAS3-305	Furnishing Automatic Flight Control Systems	Minneapolis-Honeywell Regulator Co.	140,000	140,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY High-energy fuel rockets	NAS3-262	Propellant Tank Assemblies	Douglas Aircraft Co	110,000	110,000
	NAS3-234	Furnishing rocket thrust chambers and necessary tooling	Solar Aircraft Co.	180,000	180,000

ACTIVITY: SPACE PROJECTS CENTER (LANGLEY)

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	S-1000(G)	X-248 rockets	Bureau of Ordnance (Navy)	100,000	100,000
	S-1010(G)	X-254 rockets	Bureau of Ordnance (Navy)	1,120,000	1,120,000

	Contract number	Purpose	Contractor	1959 Obligations	Total Amount of contract
PROGRAM: SCIENTIFIC INVESTIGATION IN SPACE: Earth satellites	NAS-5-53	Jupiter seniors	Bureau of Aeronautics (Navy)	1,020,000	1,020,000
	S-1013(G)	XM-45 rockets (see also "Manned space Flight")	ABMA (Chief of Ordnance, Army)	90,000	90,000
	L-55,931 (G)	TX-33-20 rockets (see also "Manned space flight")	ABM (Chief of Ordnance, Army)	620,000	620,000
PROGRAM: SPACE OPERATIONS TECHNOLOGY: Manned space flight	HS-24	Atlas D boosters	BMD (AIR FORCE)	1,400,000	*
	HS-36	Atlas D boosters	BMD (AIR FORCE)	5,600,000	*
	S-1013(G)	XM-45 rockets (see also "Earth satellites")	ABMA (Chief of Ordnance, Army)	120,000	120,000
	NAS5-51	Booster hardware, sets for TX-33	Aerolab Development Co.	70,000	70,000
	NAS5-55	XM-19E1 rockets	Thiokol, Inc.	110,000	110,000
	L-55,931 (G)	TX-33-20 rockets, TX-33-22 rockets (see also "Earth satellites")	ABM (Chief of Ordnance, Army)	2,200,000	2,200,000
	HS-44	Part of Redstone boosters	AOMC (Army)	4,490,000	15,500,000
	NAS5-57	Transport vehicles and launcher (S-91-4)	North American Aviation Missile Division	400,000	400,000
	HS-54	Jupiter boosters	AOMC (Army)	2,740,000	4,450,000

*Total amount of contract still under negotiation

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

February 17, 1959

HOLD FOR
RELEASE UNTIL
LAUNCHED OR
SCRUBBED

NO. 7
EX 3-3260
Ext. 6325

PROJECT VANGUARD BACKGROUND

On July 29, 1955, the White House announced that the United States planned to launch earth satellites as part of this country's contribution to the International Geophysical Year which ended formally on December 31, 1958. Project Vanguard is the name assigned to that part of the satellite program which was under the management of the Chief of Naval Research. The Naval Research Laboratory (NRL) in Washington, D. C. had responsibility for technical aspects of the program.

Project Vanguard was transferred to the National Aeronautics and Space Administration by Executive Order on October 1, 1958. The transfer affected 156 NRL scientists and technologists, including Dr. John P. Hagen, Project Vanguard director.

Six firings of the Vanguard test vehicle and three firings of the Vanguard satellite launching vehicle have been made to date, starting with the May 1, 1957, experiment. One Vanguard satellite has achieved orbit - - a three-and-one-quarter pound test sphere which was launched on March 17, 1958 (its 50-pound third stage rocket casing also went into orbit). Vanguard I, as it was christened, is still aloft, with an expected lifetime of hundreds of years. (See press release 3 for Vanguard table.)

On September 26, 1958, Vanguard Satellite Launching Vehicle 3 (SLV 3) bearing a cloud cover experiment, was fired. The upcoming cloud cover experiment is essentially a repetition of the September 26 experiment. SLV 4 will attempt to place about 70 pounds in orbit - - a $21\frac{1}{2}$-pound, 20-inch diameter sphere plus the third stage rocket casing which has been treated with special coating to facilitate optical tracking.

The primary objective of this experiment is to measure the distribution and movement of cloud cover over the daylight portion of the satellite's equatorial orbit and relate it to the overall meteorology of the earth.

This experiment, and three Vanguard launchings to follow, represent a completion by NASA of the Vanguard IGY series. Data from the satellite will be made available to the 66 nations of the IGY.

The U. S. Cloud Cover experiment is a NASA project carried out by the space administration's Vanguard Division. The three-stage Vanguard satellite launching vehicle was developed by the Office of Naval Research for the IGY program. The NASA worldwide Minitrack network will track and interrogate the satellite. The U. S. Army Signal Research and Development Laboratory designed and developed the cloud cover package within the satellite, the shell of which was prepared by Vanguard Division scientists. (See release No. 4 for details.)

END

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA CLOUD COVER SATELLITE CONFERENCE

February 17, 1959

Auditorium
1520 H Street, N. W.
Washington, D. C.

P R O C E E D I N G S

MR. BONNEY: Ladies and gentlemen, I am Walt Bonney. We are all set to go. I have one announcement of some importance. 1959 was declared an 11-month year and this is really St. Patrick's Day. (Laughter.)

It is my very proud pleasure to introduce to you the Administrator of the National Aeronautics and Space Administration, Dr. T. Keith Glennan.

DR. GLENNAN: Gentlemen, this is a particularly happy day for us at NASA, as you well know. Before making a few personal comments about the successful launching of Vanguard II, I want to read a message which has just come from the White House.

The President sends his congratulations and asks that they be conveyed to all who participated in the successful launching into orbit of Vanguard II.

You know last fall on 1 October the Vanguard project was transferred by Executive Order to NASA. That is NASA, not "Nasser." (Laughter.) We had great faith in this project as it came to us because of the very fine group of people that have worked on it.

You must remember that this was the project which was started from scratch as a satellite launching project, as a part of the International Geophysical Year. Today I think that faith has been amply justified. The men on the project themselves I am sure were disappointed when early in our administration of it we asked that it be delayed, that firings be delayed until a reexamination of the vehicle itself could be completed.

Whether or not that reexamination had anything to do with the fact that this was a successful launching, I suspect will be developed in time but in any event, we delayed it not because we didn't have faith in the project, but because we did have faith in the people who were carrying it on. And one reason for that confidence was the faith that Dr. Hagen himself had in Vanguard and I want particularly to compliment him and his fine group who carried this thing through today's successful launching.

I think the reason that Vanguard personnel transferred to NASA was that they wanted to continue to work in space and that we expect that they will do.

The finishing up the further firings of the Vanguard vehicle also remain, some three of them, and in the meantime we are accepting other assignments within our organization as we press forward in to wider and wider fields in this space exploration area.

John would have wanted to be here, I am sure, but he wanted more to be down at the Cape, with Don Masern, the Vanguard project manager and his assistant, Bob Gray, to take the blame, if there was any, for a failure. Thank goodness he had a success.

And to every one of the loyal and dedicated Vanguard crew here at Washington and at the Cape, and the atroelectronics division of the United States Army Signal and Research Development Laboratory, to every one of the industrial organizations that participated in the Vanguard work beginning with the Martin Company, many others, go our congratulations and thanks.

Now you have heard enough from me. I would like to introduce to you the Director of our Space Flight Development Division. I know he too wanted to be at the Cape today, but someone has to stay here and worry about the next set of problems.

Dr. Abe Silverstein.

DR. SILVERSTEIN: Gentlemen, the early information released on the satellite has been confirmed by new measurements. The perigee is 335 miles. The apogee is 2,050 miles. The period is 126 minutes; inclination, 34 degrees. The satellite was launched at 10:55, and injected into orbit at 11:05. These data are subject to further correction as the data are worked up.

QUESTION: Sir, please repeat that.

DR. SILVERSTEIN: All the members?

Perigee, 335; apogee, 2,050; period, 126 minutes; inclination to the Equator, 34 degrees; launching time, 10:55; the injection into orbit, 11:05 Eastern Time.

QUESTION: Doctor, do you have anything on the expected lifetime of the satellite, and the maximum speed?

DR. GLENNAN: The lifetime of the orbit of course is going to be very long, perhaps hundreds of years; it is hard to tell. We have calculations, of course, that will determine that, but there are enough unknowns so we don't know exactly.

QUESTION: What about the speed?

DR. GLENNAN: The speed, as you can tell from the apogee, is quite high. I think the initial calculation -- let me check -- about 2 percent; it was about 2 percent over nominal satellite speed. That would be 18.5, about 18,000 miles an hour.

QUESTION: Was this 2 percent over that, you mean? You mean it is 18,000 plus 360, is that what you mean?

DR. GLENNAN: No, nominal 18,000.

QUESTION: Could this overperform then, as far as this experiment is concerned in producing too high an apogee?

DR. GLENNAN: No, I think not. We will go into this a little more in a few minutes, as soon as we get through our speakers here.

Now, it is my pleasure to introduce to you people who have very importantly participated in this program and first I would like to call on Dr. Richard Porter, the Chairman of the Technical Panel of the Satellites of the United States National Committee for the IGY.

Dr. Porter.

DR. PORTER: Gentlemen, on behalf of the IGY Committee of the National Academy of Sciences, I congratulate the National Aeronautics and Space Administration and its Vanguard Division under Dr. John P. Hagen on their accomplishment in putting Vanguard II or 1959 Alpha, as we shall call it, in orbit today.

We have waited a long time for this event and I am sure that all of us who have been interested in the United States IGY Satellite Program are very happy today. We are especially proud of the U. S. Army Signal Corps for the splendid way in which they carried out the development of the cloud cover experiments that was carried in the Satellite. This latest contribution by the United States to the Geophysical Year and its continuation, which is referred to as International Geophysical Cooperation, 1959, will be welcomed by scientists everywhere as the beginning of a new era in weather research.

As in the case of the other satellites launched by the United States as part of the IGY program, all of the scientific information gathered by 1959 Alpha will be shared with scientists and other nations in accordance with the principles of information exchange developed during the IGY.

To all who had a part in today's launching, we say thanks and well done.

DR. SILVERSTEIN: Thank you, Dr. Porter.

Next I would like to call on Dr. John T. Mengel, who heads the Radio Tracking Branch of the Vanguard Division of NASA. John.

DR. MENGEL: Well, I have very few comments to make except this is a very pleasurable day for us at Vanguard and NASA. The tracking of this satellite is being accomplished at the present time through the chain of Minitrack stations in North and South America, in South Africa and in Australia.

It has so far progressed over the first station at Antigua in the British West Indies, it was picked up at the South African Station, and picked up again at San Diego, at Havana, at Fort Stewart, at Blossom Point, and again at Antigua on the second pass around, and this was the last bit of information we had from it before coming down to this meeting.

DR. SILVERSTEIN: Are there some stations which have not received the tracking?

DR. MENGEL: The normal progression of the orbit over this chain of stations takes it first over northern stations as it fired from Florida and every orbit takes it further south, in succeeding, it goes down over Quito, Ecuador; Lima, Peru; Antofagasta, Chile; Santiago, Chile --

DR. SILVERSTEIN: Jack, this is six stations then?

DR. MENGEL: Six so far.

DR. SILVERSTEIN: Two of those twice?

DR. MENGEL: That is right.

DR. SILVERSTEIN: Did you interrogate it on the pass?

DR. MENGEL: It was interrogated over Antigua successfully, and interrogated at San Diego over the completion of the first orbit successfully.

DR. SILVERSTEIN: Can you tell us anything about what the results of the interrogation or was that just a tracking interrogation?

DR. MENGEL: That was an interrogation for telemetry, but this put the data on a magnetic tape and this tape has to be sent in for.

DR. SILVERSTEIN: How soon do you think you might have the earliest results of that?

DR. MENGEL: I will have to leave that for Dr. Ziegler to answer.

DR. SILVERSTEIN: My point is on your pass over San Diego after completing nearly one orbit, did you get back telemeter information?

DR. MENGEL: It was interrogated and gave very successful telemeter data during that interrogation.

DR. SILVERSTEIN: Next I will call on Dr. Hans Ziegler, who is the Director of the Astro-Electronics Division, U. S. Army Signal Research and Development Laboratory at Fort Monmouth, New Jersey. Dr. Ziegler.

DR. ZIEGLER: Gentlemen, the electronics package which you see here in this exhibit, which is flown on the newest United States satellite is the result of untiring efforts of a small group of devoted scientists and engineers in the Fort Monmouth Signal Laboratory. They have carried this work through two and one-half years of sometimes desperate efforts and they are very proud that they finally have received their goal to see this satellite in orbit. We are particularly proud, since this is actually so successful a package which has been developed in our laboratory, the first solar power supply of 1958 Beta, the well-known communications package in the Atlas Satellite before Christmas, and now the latest satellite in 1959 Alpha.

I am sure you will have a number of questions which go beyond the press release which we have distributed to you in the package and I will be available to you in the answering and question period.

DR. SILVERSTEIN: Thank you, Dr. Ziegler. Let me call on next Dr. Joseph Sirey who is head of the Theory and Analysis Branch, Vanguard Division, in NASA. Dr. Sirey.

DR. SIREY: Dr. Silverstein and gentlemen, the earliest estimates indicated that the launching vehicle performed somewhat in excess of the expectations we had of it. The perigee height and apogee height were somewhat greater than we had expected from the normally performing vehicle.

The perigee height is about 335 miles, and perigee is somewhat north of the equator, and it occurs a little after local noon, so that the satellite is in an especially good position from the orbit point of view to do this job of taking pictures in the sense we expect of them here, of clouds.

The orbit will be in daylight from its maximum inclination of about 34 degrees down on the portion of the orbit that descends from the northernmost portion to the equator and around to the southernmost portion, in other words, it will be daylihgt on that half of the orbit.

Apogee occurs a little after midnight, a little below the equator on the opposite side of the earth.

DR. SILVERSTEIN: Thank you.

Now, I think we can open the meeting here, to questions, and try to answer them with the panel we have here.

QUESTION: Could Dr. Sirey take us through that a little bit slower?

QUESTION: Maybe you can go to the globe.

DR. SIREY: You can imagine the sun is off in your direction; the sun is off in your direction, and the satellite went into orbit about here (indicating) and perigee occurs about here (indicating) so that the satellite is closest to the earth in the region of noon near the equator, and this is desirable from the point of view of accomplishing the mission of the experiment. Apogee is around on the opposite side of the earth, a little after local midnight, and a little below the equator.

The satellite should stay in orbit for at least a decade. The maximum latitude is about 34 degrees and occurs about here (indicating). The minimum latitude is again 34 and occurs here (indicating), so you can see that this (indicating) is the branch of the orbit that is in sunlight, and it is the perigee portion of the orbit that is near local noon, and hence, will allow the satellite to do the best job it can for recording the cloud cover.

QUESTION: Now your perigee does not stay fixed, does it?

DR. SIREY: Sir, that is right, this is the present situation.

QUESTION: That will change and it will see the rest of the equatorial band in daylight?

DR. SIREY: That is right, perigee will advance in the orbit and the orbit will regress.

QUESTION: Now, will the perigee stay approximately at local noon as it changes?

DR. SIREY: No, it will not.

QUESTION: How long does this condition prevail that you are talking about?

DR. SIREY: Something in the order of a week or so, week or two.

QUESTION: Then what happens?

DR. SIREY: Then both perigee advances in the orbit and moves around ultimately to the other side and the whole orbit precesses.

QUESTION: Which way will it precess?

DR. SIREY: It precesses in this direction (indicating).

QUESTION: To the West?

DR. SIREY: That is correct.

QUESTION: Will the perigee point move south to the equator?

DR. SIREY: There is a small degree of cancellation; in other words, as the orbit rotates in this direction (indicating), perigee moves in the orbit in this direction (indicating.), so that it does not move away from local noon as rapidly as it would if only one of those effects took place.

QUESTION: Well, two things are happening, the plane of the orbit is precessing to the West, and the perigee is moving south?

DR. SIREY: Is advancing to South and East, so that as they say, it will stay relatively near local noon for several weeks.

QUESTION: What is the axis of rotation of the satellite relative to the axis of the globe?

DR. SIREY: It was approximately parallel to the earth's surface where it went into orbit. In other words, pointed approximately in this direction (indicating), in the direction of the orbit at the time it went into orbit, and the sensors are at an angle of 45 degrees to this axis, and they sweep both fore and aft.

QUESTION: Will it ever get high enough to approach Russian territory?

DR. SIREY: Well, it can be seen in the radio and optical sense there from their territory, although it only goes up to 34 degrees latitude. This is considerably south of Russia, but apogee is up, well, 2,000 miles.

QUESTION: Do you think it could be seen or tracked from there?

DR. SIREY: One might be able to get it with one of their better optical cameras and by radio means also, I would think.

QUESTION: I believe this question is for Dr. Ziegler, but are these photocells designed to operate at perigee or can they also distinguish between light intensities at apogee?

DR. ZIEGLER: They would work only on the side of the earth which is in sunlight because it has a switch which switches off some, but as the orbit turns around, it will operate on both perigee or apogee, whichever is on the sun side of the earth.

QUESTION: Let me rephrase it, can these photocells operate as effectively at maximum altitude as at low altitude?

DR. ZIEGLER: The resolution will be much less, it will be, as you probably know, about 6 to 7 miles at 300 to 400 miles altitude and goes approximately proportionately down or the figure goes up proportionately, that means, seven times three for 2100, which would mean about 50 miles resolution at that particular distance of apogee. It is still working. You get only much bigger spots of resolution.

QUESTION: Dr. Ziegler, can you make an estimate as to when you might have the first result with regard to the weather experiment?

DR. ZIEGLER: You mean the actual --

QUESTION: Either the finished product or rough evaluation or what have you?

DR. ZIEGLER: I hate to give any exact date on this part, but I believe it will take a couple of weeks to get actual pictures.

QUESTION: Aside from actual pictures, will you have any indications of what the satellite has recorded that can be translated even without a picture?

DR. ZIEGLER: The mere fact that there is information on the tape right now -- which we heard from San Diego -- has certain sounding notes which we recognize indicates that there is cloud cover information, but to get the picture, will require a little bit of work in processing and as I indicated, we will probably want two weeks or even a little more.

QUESTION: As this progresses, for example, say this is a success and your next three are successful and other weather experiments are successful, do you envision the time when you won't have to wait two weeks?

DR. ZIEGLER: Obviously, that will be real time. Otherwise, it would not be of great value.

QUESTION: It eventually will be instantaneous?

DR. ZIEGLER: That's right.

QUESTION: Is any of this information on the tape meaningful without putting it through this complicated analog system?

DR. ZIEGLER: Not to any extent. It only indicates now that everything has worked properly, but in order to evaluate it, it requires a process which is quite complicated.

QUESTION: When you say resolution of five or six miles, what do you mean by that?

DR. ZIEGLER: You have dots with a diameter of that number of miles I mentioned to you.

You would say, when the photocell looks down, it integrates the brightness when over such an area. It cannot distinguish between details in that area, so every time it looks down, it integrates over brightness of a dot of that size, which is seven miles, at 300 miles altitude or 50 miles, at the present apogee.

QUESTION: Doctor, do you have any tracking on the third stage casing as yet?

DR. ZIEGLER: I think this is something Dr. Mengel would be able to answer.

DR. MENGEL: There is no electronic tracking on that.

QUESTION: When do you expect it?

DR. MENGEL: On the rocket casing?

QUESTION: Yes, sir.

DR. MENGEL: That has not the requirement of having radio tracking on it. Radio tracking has been included only in the package including the scientific experiments.

QUESTION: It is right along with the sphere now, isn't it?

DR. MENGEL: Originally, of course, it was at the same spot as the sphere, but on separation, there was a small separation velocity imparted between the satellite and the bottle itself, maybe three or four feet a second, something like that, and this just integrates forever, so that if it is 1,000 seconds later, why it is three or four thousand feet apart.

QUESTION: Dr. Silverstein, I believe this one is for you: Dr. Glennan said that after you took over the Vanguard Project, you asked that the firings be delayed until a re-examination of vehicle could be undertaken. Now, I take it that you did re-examine the vehicle. What did you do about it after you examined them?

DR. GLENNAN: We set up a panel of qualified people to look at both the vehicle and method of operations. These people reported their findings to us, both the Vanguard Division and to the various industrial crews that have performed in the work.

Changes were made as a result of the study, which I think may have or may have not contributed to the successful flight.

QUESTION: Were there detailed changes or basic changes in design or what?

DR. GLENNAN: The changes were operating procedures at launch, involving minor, I would say, design changes, and changes in some of the equipment.

QUESTION: Ground equipment?

DR. GLENNAN: Not ground equipment.

QUESTION: What sort? The equipment inside the vehicle?

DR. GLENNAN: Yes, sir.

QUESTION: Specifically what?

DR. GLENNAN: Well, I prefer not to get into detail here. I can perhaps later, but it is a long story.

QUESTION: Doctor, we have put a lot of money and time into this, we would like to know what went wrong?

DR. GLENNAN: You never know what goes wrong in these flights, as you realize. A vehicle of this type, which is so complicated, which has so many parts, what you try to do always is to look at each piece of it as closely as you can and each part of the operations as closely as you can, examining carefully from all of the experience of the people in the field and try to do each piece of it as well as you can.

Now, there are many minor things, some appear to be negligible in importance, others perhaps are more important, and what we have done is go through the thing with a fine-tooth comb, examining each piece of the equipment and each part of the operation, making suggestions here and there, as to how possibly it might be done a bit better. You can see, there are many items here, and you can recount them, it is very difficult.

QUESTION: Well, not all of them, but what were two or three of the most important physical equipment changes you made in the Bird?

DR. GLENNAN: I think you recall that in one of our earlier flights, there was some question as to whether the injector of the rocket had plugged because of foreign material in the fuel. A very careful study was made on this point and we did provide methods by which there could be no foreign material in the fuels. It is a typical item.

QUESTION: Did you do that on the ground or inside the vehicle?

DR. GLENNAN: It was done by control of the manufacturer of the vehicle.

QUESTION: Were there any changes in the vehicle itself?

DR. GLENNAN: There was a change in the vehicle because in one case there was foreign material in it and in the other case there was not.

QUESTION: Were not most of your fixes in the second stage and in the connections and so on?

DR. GLENNAN: I would say the fixes were basically throughout the vehicle. There were probably no one spot that you could pick that had more fixes than another. They were distributed.

QUESTION: Have all these fixes been duplicated on the three other vehicles that still remain to be fired?

DR. GLENNAN: Not as yet, but they will be, and possibly some other changes too that we have considered but have not put into this one.

QUESTION: Is there any indication you might be able to increase the payload in forthcoming vehicles?

DR. GLENNAN: The payload will be increased in the last vehicle.

QUESTION: To what?

DR. GLENNAN: The payload will be close to 50 pounds in the last vehicle.

QUESTION: 50 pounds?

DR. GLENNAN: Yes, sir.

QUESTION: Can you outline what the mission is of the later vehicles will be?

DR. GLENNAN: One in July -- you better take this one in detail.

MR. NEWELL: There are still three Vanguard firings to come up. One will carry a magnetometer, a proportional magnetometer to measure the earth's main magnetic field and more importantly, the fluctuations in the magnetic field. This firing will also carry a 30-inch inflatable sphere to be injected at the time of separation of the magnetometer from the third stage, and will be separate from the third stage casing and from the magnetometer package itself. The idea of the 30-inch inflatable sphere as a light object with a large cross-section so that the effect of air drag will be magnified and one can get air density data more quickly than one gets it from a heavier more dense satellite.

Another Vanguard firing will carry a radiation balance satellite, the idea in this case is to measure the difference between the energy input to the earth, which of course is primarily from the sun, and the energy reflected by cloud cover, the ground and water, and the energy re-radiated by the atmosphere.

The final Vanguard satellite will contain a repeat of the solar radiation measurements, that is, the measurements of X-rays and ultraviolet light from the sun that was included in the first satellite launchings, that is launching attempts, the attempts of the satellites that didn't go into orbit.-- a repeat of the magnetic field measurement described in my first description here.

QUESTION: That will be the 50 pound?

DR. NEWELL: That will be the 50 pound one. You see that is a combination of two satellites in one.

QUESTION: Which one is that?

DR. NEWELL: The fifty pound one.

QUESTION: Yes, sir.

DR. NEWELL: That is the combination of solar radiation measurements with the magnetic field measurements.

QUESTION: Does solar radiation include X-ray gamma radiation?

DR. NEWELL: Not gamma, but X-rays and Lyman Alpha.

QUESTION: Are you going to take lower orbit or do something to increase the payload?

DR. NEWELL: The third stage will be an improved stage. This is how we get the increase in the payload.

QUESTION: Do you expect to have solar batteries with any of these future satellites, these three Vanguards?

DR. NEWELL: Not on the Vanguard.

QUESTION: None of them?

DR. NEWELL: No.

QUESTION: Didn't you use solar batteries for ten milliwatts to give it permanent life?

DR. NEWELL: In the first Vanguard, Vanguard I, of course, we do have solar power supply, it can be used. But it is not planned for the future ones.

QUESTION: Why not?

DR. NEWELL: Well, it was simply a matter of engineering. These things got underway before the design of the solar system had been sufficiently fixed on and we could get it in.

QUESTION: Dr. Newell, the magnitude of your orbit on this satellite would indicate that you had more than enough energy to tuck a few more pounds in that thing, maybe another experiment. Apparently this thing is designed to operate at perigee, and it will not work so well at apogee, so the apogee is something you don't really need.

DR. NEWELL: Yes, sir, I feel we could have put more in, but this is something you didn't know back at the time when you had to close off your engineering design.

QUESTION: But if the future satellites behave the same way, maybe you could cram something else in there?

DR. NEWELL: You see, these are practically built now.

QUESTION: Dr. Newell, this next one will carry the magnetometer into orbit and also there will be an inflatable sphere, is that correct?

DR. NEWELL: Yes, sir.

QUESTION: There will be two satellites?

DR. NEWELL: There will be three if you want to count the empty third stage.

QUESTION: Can we go back to the experiment? In your original description of your experiment you said you were expecting a perigee of 200 to 300 miles. You are a little bit above that perigee. What effect does this have on the percent of the earth's sunlight surface will be covered? In your statement you say the satellite's 24-hour sweep should reveal cloud cover data over about 25 percent of the earth's sunlit surface in 600-mile-wide strips.

DR. ZIEGLER: The actual improvement on this is relatively small because we still work only in perigee region which as we indicated originally came from 200 to 400 miles and now is in the order of 335. Of course it will be a little bit better than 300 miles originally planned, but there is no real significance. There is a little bit more but there is nothing drastically changed particularly. An apogee is in on the dark side and we do not use it. An apogee will not move during the lifetime of this equipment to the other side. The batteries on the cloud cover experiment have only two week's plus life, and during that time no actual changes take place.

QUESTION: Will you explain to me why it is that south of the Equator it will be in varying degrees of darkness?

DR. ZIEGLER: This is maybe a little bit of a fuzzy expression, I would say. We have the major portion of the lighted globe on the northern hemisphere and the part of the Equator is still on the sunlit side, but it is only to, I would estimate, some 20 degrees south or something like this.

QUESTION: I don't understand this, when it is daylight in New York, isn't it also daylight in Lima, Peru?

DR. ZIEGLER: Yes, sir.

QUESTION: Then it isn't in darkness below the Equator?

DR. ZIEGLER: No, but satellite you won't see it just at this time where it comes over because it was in San Diego at this time at noon, for instance, today, right, so we didn't see below the Equator at that time.

DR. NEWELL: Let me take a crack at that one. You think of the sun's radiation coming from that direction, the portion of the earth which is illuminated is that hemisphere on this side (indicating). Now as you know when the satellite is launched into an orbit, the orbit lies in a fixed plane, so this fixed plan then, you see, intersects the plane of the twighlight zone in a couple of points here. This then divides the orbit into two pieces, the portion that is in the lighted part, and the portion that is in the dark part.

Now the fact that the earth is rotating does nothing to that geometry, that stays fixed. So it is only when the satellite is in the lighted portion of its orbit, that it is lighted, that it sees an illuminated earth underneath, you see. When it is over here (indicating) it never sees an illuminated earth.

Now there are two effects that tend to change this geometry relative to the earth, one is that this plane here (indicating) recesses. That will tend to change the portion of the orbit that is lighted. The other is that the earth is revolving around the sun and that will tend to change the direction of the plane of the twilight zone by one degree per day.

Those two will combine to change things. However, as Dr. Ziegler mentioned, since the lifetime of this satellite payload is only two weeks, there won't be too much of a change.

QUESTION: What happens, practically, is --

MR. BONNEY: Please, may I break in to be the devil's advocate for a moment and ask a couple of questions on behalf of the press down at Patrick. Some of these I am sure have already been answered, but just to get on the record, to be answered again, the first one is, is there anything in the payload except the cloud cover photocells?

DR. MENGEL: Minitrack transmitter and batteries for the transmitter.

QUESTION: And Mengel says temperature indicator.

MR. BONNEY: Temperature recording device.

DR. MENGEL: That is a characteristic of Minitrack, its frequency reflects that.

QUESTION: And tape recorder and some solar cells to turn it on and off.

DR. ZIEGLER: That is part of the package.

MR. BONNEY: The next question which we can answer, and I can answer it myself, when will the next Vanguard be fired? We will tell you about that some other day.

What will be the objectives? This is the next one, that is the magnetometer.

QUESTION: I have a question for Mr. Bonney.

Walt, earlier today, somebody announced that the United States Army Signal Research and Development Laboratory at Deale, New Jersey, had picked up signals on this thing at three minutes and forty seconds after the launch time on the 108 megacycle band, and I couldn't find Ft. Monmouth group among the tracking stations so I went back to the army man who told me about this. By the time I got back, he said you people had told him not to talk about it any more. What is happening?

MR. BONNEY: First off, I don't think that Ft. Monmouth is part of the Minitrack system.

QUESTION: Are they tracking?

MR. BONNEY: I will have to ask the Army.

DR. ZIEGLER: Yes, sir.

MR. BONNEY: The answer is Yes, sir.

QUESTION: Well, who else is tracking besides Mr. Mengel's outfit?

MR. BONNEY: I suspect that a great many people are trying to track it, one way or another.

QUESTION: Well, is there some worldwide network that --

MR. BONNEY: Not an official one other than the Minitrack system.

QUESTION: I see.

A question along the same line. The types that are being picked up at the tracking stations, how are they being communicated to Ft. Monmouth?

MR. BONNEY: They are being physically transported.

QUESTION: Could we ask Dr. Ziegler to tell us something about how these tapes will be deciphered?

DR. ZIEGLER: I think now you hit the jackpot. (Laughter.) I think I can only explain it in very general terms and with an analogy. As you know, the Minitrack stations build and have already determined the orbital elements and we know the positions of the satellite at every instance with regard to the earth. On the other hand, we know from signal observations as well as from the tape that the satellite itself rotates with a certain speed, which will decrease as time goes on, but we can detect it as well from the signals which we observe at the Minitrack stations from the tape which we take out of the instrumentation for the cloud cover.

So we know the orbit conditions and we know the spin rate of the satellite. Now the next thing we still have to know is the attitude of the satellite with regard to the earth. Now this attitude we know to some extent from the insertion point, and we know it again from the tape, because as the photocells spin, they trade different figures on the earth. If they are parallel, they make two symmetrical moon shape traces. If they are looking down on the earth, they would make a circle, and every figure in between.

Now from the lengths of the tapes between the one cell recording and the other cell recording, or one cell recording and the other not recording, we can deduce the position of the satellite. Now, what the computer in effect does, I can only explain this way: If we know all these three things, the exact orbit, the spin rate, and the attitude, then we would be able to build a model of what we just made actually in actual size. We would use a globe which would have the surface of a projection screen and by some mechanical means have a little gadget which represents the satellite orbit around, and we would rotate it with the same speed, and we would let it have the same attitude against the axis of the earth, and then the next step still would be to put two little light beams in, and then those light beams would on that projection, on that sphere, project the same kind of figures as the actual photocells pick up on the earth.

Now comes the last step, if we would now modulate that light with the intensity from the tape, then the light would fluctuate, and you would get bright and dark spots on the projection screen and then you take a camera and photograph with still camera and integrate all those dots and you would get a picture of what actually has been taken up. Now this is not being done, but the computer does exactly those things. You feed in the orbit information, you feed in the tape once for evaluation of rotation, spin rate, and position, and then you feed in addition, once more the tape in for its actual modulation information and that gives you finally the output form of a cloud cover picture on an oscilloscope screen.

This is in a sense what is being done. It is rather complicated, but I believe that model (indicating) shows you that it is not so complicated that a computer cannot do it.

QUESTION: How fast is that spinning, by the way?

DR. ZIEGLER: I don't have the exact figure, but it should be around 50 RPM. Do you have a figure yet? Probably 50 RPM.

QUESTION: How many and what sort of assortment of tapes do you need to get an accurate picture?

DR. ZIEGLER: This is a difficult question. There is only -- each tape presents one picture. If you go over it again you have another picture, right, and there is no way of saying, I have one picture, and I prove it with another type. You have a cloud picture and that is it.

QUESTION: Did you say it will take you two weeks to take this tape from San Diego and reduce it to --

DR. ZIEGLER: No, this method which I described very crudely here, is presently integrated in a computing device, but many things have to still be tried out and there may be certain bugs which have not been resolved and we don't wantto promise you and have you come back every day and say you promised yesterday and we haven't gotten it.

QUESTION: Dr. Ziegler, beyond the mere military aspects of weather forecasting, what possible military applications does this kind of a cloud cover scanner have?

DR. ZIEGLER: None at all.

QUESTION: None?

DR. ZIEGLER: No.

QUESTION: Could it be adapted as an espionage device?

DR. ZIEGLER: With a resolution of seven miles, you could not distinguish anything. If we get a cloud outline or an island or crude outlines of land, and see masses, and the clouds in their big structure, this is about all we can expect, but no surveillance capabilities.

QUESTION: Would there be an overlap of pictures?

DR. ZIEGLER: This depends on orbital conditions. There could be on perigee, there could be a slight overlap of the pictures.

QUESTION: What do you do with your problem of deciphering this as soon as it begins to wobble?

DR. ZIEGLER: As soon as it starts, which will not happen in two weeks period of operation of life of equipment, it would be rather complicated.

QUESTION: Dr. Ziegler, this question may have been answered while I was out, what are the frequencies used for transmitting the weather data, cloud cover data?

DR. ZIEGLER: 108.030 megacycles. It is mentioned in the release.

QUESTION: With a two week's time lag, would your cloud information be of any use to the weather man?

DR. ZIEGLER: I don't think so in this case. It will be a test.

DR. SILVERSTEIN: This experiment is our first experiment in this meteorological program and currently we have more advanced meteorological program using more advanced equipment. Our attempt will be to design equipment that will give us real time information. It will take sometime, of course, to go through the whole process of building up the equipment and the equipment for resolving the pictures, but this will be a goal of the whole program.

QUESTION: Dr. Silverstein, this is a very minor point, but all the previous satellites had IGY designations. Does anything like 1959 Alpha apply to this one?

DR. SILVERSTEIN: I think it will apply -- this is a good designation for satellites and we will continue it.

QUESTION: Dr. Silverstein, the news announcement said this will allow us to get pictures of the cloud cover of 25 percent of the sunlit surface of the earth. And from the description, that would indicate that most of that is north of the Equator. Now, how does that advance us over what can be obtained on cloud cover information by previous means? How much of the earth were you able to get?

DR. SILVERSTEIN: Well, the figure isn't on the tip of my tongue. I should say that we have been able to get cloud cover currently over, of course, the whole land mass and some of the sea masses of the earth. Actually, this experiment, I think, can be considered an early technological experiment in developing the art of using the satellite for meteorological purposes. As we move along, each step, we add another piece of information and build up toward finally a full-time and a real time evaluation of the cloud masses over the whole surface of the earth continuously.

QUESTION: So this particular experiment will not advance knowledge appreciably?

DR. SILVERSTEIN: I think it will advance the technology very considerably.

QUESTION: Not the present knowledge of existing cloud cover?

DR. SILVERSTEIN: I should say this is probably a correct statement.

QUESTION: Dr. Silverstein, just along that line, in the early statements, the Army or NASA said they would be able to spot individual hurricanes or typhoons as they were forming with this kind of resolution -- are you going to be able to do that or is it a little bit too rough?

DR. SILVERSTEIN: I think we will know a lot more when we see the first pictures as to the actual resolution here and how good a picture we do get. I think this is something we need to learn.

QUESTION: Will these photoelectric cells be carried in the three remaining Vanguards?

DR. SILVERSTEIN: No, not in all three.

QUESTION: Dr. Silverstein, one of the difficulties, it seems to me, in putting up something as expensive and complicated as this is, you get only two week's use out of it. What is the state of the art on solar batteries, how far away are you from having a perpetual weather forecaster?

DR. SILVERSTEIN: I think you know that the first satellite test vehicle which carried solar batteries has been in operation since its injection, and operating satisfactorily. In some of our future satellites, we plan now to use very much larger installations in the batteries.

QUESTION: Could you get a watt of power out of solar cells now?

DR. SILVERSTEIN: Yes, sir.

QUESTION: How much power do these two transmitters require?

DR. SILVERSTEIN: One of them is a watt and one has a ten milliwatt.

QUESTION: One watt and ten milliwatt?

DR. SILVERSTEIN: One for the data is a watt and the other ten milliwatts.

QUESTION: Why didn't you put a watt and ten milliwatts into this instead of mercury power?

DR. SILVERSTEIN: I think you should realize that in all these solar type packages, there is a lead time of at least a year or year and one half to put these packages together, and get them checked environmentally to be sure these things are going to operate after they have gone through vibrations associated with takeoff and the accelerations they go through. These packages take some four to six months of environmental testing after they are put together just to insure that they are going to work properly.

Now with the lead time we are working on, it was not possible to put these technological improvements in to the satellites at the time they were originally designed.

QUESTION: Dr. Silverstein, I wonder if we could get Dr. Wexler, as a meteorologist, to explain a little of the implications, as to what he will know after he has gotten two weeks of data.

DR. GLENNAN: Is Wexler here?

VOICE: He had to leave for another meeting. Cortright is here.

MR. BONNEY: We will be having a press conference as soon as the data have been studied and figured out what is coming from them and at that time, we will certainly expect to have somebody from the Weather Bureau to talk on that.

QUESTION: After this particular session, what is your intended schedule?

MR. BONNEY: Our intended schedule, after this session, is as soon as we get the word that they have something to talk about, to pass the word to you that there will be a press conference in which all of this information will be made public.

QUESTION: Do you have a rough estimate when that will be?

QUESTION: When can we get fly-over times on this?

MR. BONNEY: I hope before the end of the day.

QUESTION: That is when you expect to have some other --

MR. BONNEY: Only on fly-over time. As far as the results of the experiment is concerned, we defer to the Army and they say it may be a considerable number of days.

QUESTION: How about pictures and sketches and artwork?

MR. BONNEY: The pictures, you mean of what they have gotten, or the pictures that the photocell is taking?

QUESTION: No, the pictures, do you have any diagrams or sketches of the theory of this thing?

MR. BONNEY: Yes, sir, those will be available at the end of this conference.

MR. CORTRIGHT: Gentlemen, the meteorological satellite offers advantages to us for several obvious reasons, I think. One, it permits us to observe the meteorological conditions over the entire surface of the earth, that is it will eventually compare with perhaps ten percent coverage, which we have today. This will give us access to portions of the earth which are important to weather all over, of course, and to the Northern Hemisphere and our country in particular, which we do not now have access to. In addition, the satellite will enable us to look at the weather from a point of view we have never before had, namely, from the other side above it.

There are opportunities then to obtain data of a type which we cannot now obtain; the most obvious type of data, of course, is cloud cover, and we have hopes of eventually developing instrumentation which could determine the extent of cloud cover, the types of clouds, the heights of clouds above the surface of the earth, the layers, perhaps precipitation associated with cloudiness, locations of electrical storms and that sort of thing.

In addition there are a number of temperatures which it will be possible to measure: The temperature perhaps of the tropopause, of the stratosphere; temperature of the earth's surface. By measuring surface temperatures, we will be able, we think, to trace out some of the currents of the ocean, and in a more accurate manner than we now know them. In addition, we hope to be able to use these satellites to measure constituents of the atmosphere, such as distribution, such as water vapor, and ozone. By doing all of these things, we hope to enhance our general knowledge of meteorology and by a better understanding of meteorology, to enjoy the benefits thereof which we all can envision, I believe.

QUESTION: Would you give us your full name, please?

MR. CORTRIGHT: My name is Edgar Cortright.

QUESTION: Spell it. Spell the last name.

MR. CORTRIGHT: C-o-r-t-r-i-g-h-t.

QUESTION: And you are with the Weather Bureau?

MR. CORTRIGHT: No, I am with NASA.

QUESTION: Is that Doctor?

MR. CORTRIGHT: Mister.

QUESTION: Meteorologist?

MR. CORTRIGHT: General.

QUESTION: General meteorology?

MR. CORTRIGHT: No, general technology.

QUESTION: Is it planned eventually, Mr. Cortright, to depend on one of these things or perhaps two or whatever we get up, rather than an international grouping? There was some talk of possibly joining forces with the Soviets and various other people to get the best kind of a weather interlocking system possible. Is that something that looks promising or what?

MR. CORTRIGHT: In our own long range planning, we envision a system of multiple satellites and these would include satellites in polar orbits in the intermediate altitude range. Perhaps, for example, from 500 to 1,000 miles. These relatively low altitude satellites would make many detailed measurements, on that, utilizing infrared detectors, thermistor bolometers, photocells, television, radar, and all the various techniques we have of measuring radiation from the earth and its atmosphere.

QUESTION: How many would you like to have to have the best or the ideal?

MR. CORTRIGHT: I don't think we know the answer to that yet. It is easy to sit down with a piece of paper and put down six, and it looks reasonable, but it is premature to anticipate that at this time. It is anticipated that some higher altitude satellites would be a part of this system, perhaps in the 22,000 mile equatorial orbit. This type of satellite sits overhead, as you know, and can be used to observe situations at the whim of the meteorologist and to watch weather situations develop.

QUESTION: You are going to have to have some pretty fine optical systems in anything like that to get any resolution on top of clouds, aren't you?

MR. CORTRIGHT: I think not. I think the optics are not the limiting factor, even in the 22,000 mile orbit.

It is more apt to be the scanning system such as a television type scanner. One of the major problems, of course, is the communication problem, which is generated by obtaining so much data. In fact, even a fraction of what I have described here will saturate the world's communications system unless we go to such techniques as satellite data relays.

QUESTION: How would that operate?

MR. CORTRIGHT: I think that is getting a little bit beyond the scope of the meeting today. This is in the area of communication satellites, where we relay from one satellite to the other, very wideband information, and then back down to some weather center in the United States. There are various ways it can be done. It can be satellite to satellite, or satellite to ground to satellite to ground to satellite to ground sort of thing. But it does enable us to use high frequency which is normally limited to line of sight communication over large distances by going to these very high altitudes.

QUESTION: Mr. Cortright, do you mean if you had six or seven of these things up there, the data would saturate the earth's communication facilities?

MR. CORTRIGHT: If you have one of them up there taking any large amount of television data, you will saturate the world's communication, transoceanic communication. Let's remember that we don't have a television link to Europe today.

QUESTION: Is that because of the enormous band widths necessary to move a signal, is that what you mean?

MR. CORTRIGHT: Yes, sir, that is the reason, the current trans-Atlantic cable has capacity for about 36 voice channels, and one television program would be equivalent to about 1,000 voice channels.

QUESTION: Walt, is there going to be some kind of a hand out on the Vanguard computing center? I understand you have one here waiting to release it, is that right?

MR. BONNEY: Yes, sir, we have one of those.

QUESTION: Also, Jack, John Dyer from down there, said to ask you about whether some of us could go in the back shop there and see that thing?

MR. BONNEY: I think that can be worked out, tomorrow. We will certainly try to. We would like to cut it off, if we could, in about two more questions, but before we get those, if I could just make a couple of detailed announcements.

We hope to have black and white art here by about 7:00 o'clock or 8:00 o'clock this evening. We will have the phone staffed so that you cancall in ahead of time and they will be ready just as soon as they can be printed up.

The color transparencies, we believe, will be ready by about midnight.

Now, Ed.

QUESTION: Dr. Ziegler, you say you are going to get strips, 600 miles wide?

DR. ZIEGLER: Pictures will be 300 by 300 miles, they will select pictures 300 by 300 miles.

QUESTION: The earth will have turned around about 1500 miles, that is, while the satellite is rotating, the earth turns under it. Will these things overlap?

DR. ZIEGLER: On perigee, they will hardly overlap, maybe a very slight overlap. On the apogee, they probably would very much. We won't take any picture of this. If we say we do not give you strips of 800 mile widths, it is for the reason that we want to give you the center picture which has the best resolution which we felt, and at this time, we are only making the first step towards such a new equipment, we will show you the 300-mile pictures in the center of that 600-mile strip.

QUESTION: In one orbit, the earth would move 1500 miles, and the next time around, it will not overlap?

DR. ZIEGLER: Beg your pardon.

QUESTION: The next time around it will not overlap?

DR. ZIEGLER: May overlap a very little bit but not very much.

QUESTION: Will any of the remaining three satellites use any of your TV or photocell experiments?

DR. ZIEGLER: Not to my knowledge.

QUESTION: Dr. Ziegler, let me get this clear, in your statement here, describing this experiment, you talk about 600 mile wide strips, now you are talking about a 300 by 300.

DR. ZIEGLER: Out of that 600 mile strip, which is actually scanned and actually is more than the 600 miles, the center piece which has the best resolution -- you know yourself, the beam is going out on both sides -- is taken out, and this is the best picture.

QUESTION: Can you elucidate what you expect this picture to look like?

DR. ZIEGLER: Like a real cloud cover, if you have seen one.

QUESTION: On a picture on an oscelloscope?

DR. ZIEGLER: It will look like a television picture, as you have seen on some of the rocket pictures.

QUESTION: Will you see the horizon?

DR. ZIEGLER: It will be down.

QUESTION: Can you sketch us a rough one and give us a rough idea of what it will look like?

DR. ZIEGLER: (At the blackboard) Here is a group of clouds in one direction, or maybe you will see a hurricane (indicating.).

QUESTION: Dr. Ziegler, would this thing be able to distinguish between the top of some clouds and, let's say, a snow-covered tundra, or something like that?

DR. ZIEGLER: It probably would.

QUESTION: Probably would not?

DR. ZIEGLER: Probably would.

QUESTION: Is it planned to compare at least on this particular experiment, to compare what your results are here with the standard weather maps for these particular areas for that time and day and so on?

DR. ZIEGLER: This might be worthwhile to do. This is the reason why we particularly wanted to have the Northern Hemisphere under observation, because then we can correlate existing weather data with the cloud data.

QUESTION: Have you sent out a request to the Weather Bureau to get all of the stuff starting at whatever time --

DR. ZIEGLER: Well, this is available very readily. It is the laboratory, and we have our own weather station and are connected to all United States and Overseas stations.

QUESTION: At any one time, Doctor, how much area does the instrument cover?

DR. ZIEGLER: I don't quite understand. You mean with each sweep, or with each orbit?

QUESTION: As it looks out at a given instant, how much area is taken in?

DR. ZIEGLER: If you take the instance which just covers the band widths of that beam which is 1.1 degree, it covers seven miles at 300 miles altitude on the center, and then it sweeps out, and it goes beyond 600 miles in one sweep. But the picture in the middle is only the one which can be evaluated.

QUESTION: Is this package, this instrument package identical to the September package?

DR. ZIEGLER: It is the same package.

QUESTION: Walt, can you give us the variation in speed, speed of the satellite?

DR. MENGEL: Several thousand miles per hour, dropped from 18, something on the order of 14 or 15. It has the highest speed at perigee and lowest speed at apogee.

It drops from around 18,000 to somewhere around 14,000, something of that order, miles per hour.

QUESTION: Walt, we had one estimate this would be in orbit perhaps hundreds of years, and one perhaps a decade. Do we pay our money and take our choice?

MR. BONNEY: It is at least a decade, which makes me think if you press me, I would bet five cents on 100 years, but I think maybe after they study it, study the orbital data a little bit more, they can come up with some firmer predictions on that.

QUESTION: Well, Dr. Silverstein was the one that said perhaps hundreds of years; perhaps he can elaborate.

DR. SILVERSTEIN: I don't think we know, that is the answer. I think we will know after -- you see, this body has a certain drag and we are learning more about it, more about the atmosphere, the atmospheric pressure all the time as we go up in altitude. There is a variation right now on the order of ten to one in our knowledge as to what the densities are. One of the later experiments in IGY as discussed by Newell is aimed to try to pin this down a bit more. Now this accuracy of ten to one in our density knowledge in the upper atmosphere, I leave it to you to guess who is right.

I think that is the character of our knowledge right now.

QUESTION: Well, let me ask you this, the grapefruit is one, Vanguard is one, is in an orbit comparable to this one, a little bit higher, but about the same. Which orbit would decay faster if they were both equal, orbit of big sphere or orbit of little sphere?

DR. SILVERSTEIN: The thing we are talking about is the ratio of the drag to the weight and the big one has a poor ratio, it has more drag per unit weight so it would decay faster.

QUESTION: This other estimate of at least a decade came out while I was out phoning, perhaps hundreds of miles -- what is the wide variation based on, Dr. Silverstein?

DR. SILVERSTEIN: I thought I explained it just a minute ago, that it is associated with the fact that we don't really know in the very highest reaches of the atmosphere, what the real density is, and the thing that brings these gadgets down is the drag, and your drag is directly proportional to the atmospheric density, and so until we learn more about the drag in these areas, we are not going to really be able to make these predictions with any accuracy.

A number of experiments are planned to study the atmospheric structure at very high altitudes, that is part of our program, but until we get this data, it is pretty much anybody's guess.

I think we will cut it off right now.

(Whereupon, at 3:25 p.m. the conference was concluded.)

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington 25, D. C.

Statement by
Dr. T. Keith Glennan, Administrator
National Aeronautics and Space Administration
before the
Senate Committee on Aeronautics and Space Sciences
February 19, 1959

Events of the month since I was last privileged to appear before your Committee have served to bring into sharper focus certain aspects of our national space program. NASA is nearly five months old. We have been picking up speed in the development of our program to the extent that it is now possible to delineate in greater detail some of the uses we can make of satellites and probes sent into space.

As a really basic ingredient in our business, as I outlined to you at the time of our earlier meeting, we have undertaken - working with the Department of Defense - an integrated program of booster rocket development to provide the means to put into orbit or send on long journeys into space the larger-sized payloads our scientists need. That program is already being prosecuted with very great vigor and before the end of 1960, the first of the building-block units of this national booster program will have become available. Not until then will the scientists be able to start such second-generation experiments as those employing advanced meteorological and communications devices and the astronomical telescope in space. If we knew of a better way to make such improved booster capabilities available earlier, we would do it.

Concurrently with the development of adequate boosters, there must be carried on very substantial improvement of our space technology capabilities. We must, for example, learn how to provide a stable space platform for the astronomical telescope. We must provide power sources that will operate, for long time periods, both the data-gathering instrumentation we send into space, and also the telemetry equipment that sends the data back to earth.

Packaging of the instrumentation, power supplies, telemetry equipment and the like, into a payload system which can be mated to the vehicle available for the experiment requires that our national capacity for this kind of service be enlarged. Presently, groups with direct experience in payload packaging include the Jet Propulsion Laboratory and the Vanguard group within NASA, and also the Space Technology Laboratories and the Army Ballistic Missile Agency. There are, in addition, a number of industrial organizations with the necessary basic capabilities and it is planned to encourage participation in this work by these latter groups.

Data-handling for the satellite and probe operations now planned is still another aspect of the total problem. We must be prepared to bring back to a central distribution point all the records collected by the world-wide net of stations, and there to make useful copies of the magnetic tapes or oscillograph records for distribution to the individual experimenters for analysis.

Already, the number of satellites and probes required for the presently-planned space sciences programs is far larger than was anticipated, even a few months ago, by those concerned with tracking and telemetry reception. Keeping track of the satellites and probes that soon will be traveling across the heavens will tax our operational facilities to the utmost.

The intensive efforts we are now making to build up our tracking and telemetry-reception capabilities are designed to enable us to keep pace with these expanding requirements.

In planning the National space sciences program, a major difficulty has been to devise experiments within the critical weight and size limitations imposed by our present ability to send only very small payloads into space. The work the scientists will be doing with these presently-scheduled 30 satellites and probes might be called first-generation space experiments.

In the development of this program, NASA has been materially assisted by advice from the Space Science Board of the National Academy of Sciences and also from other specialists and experts in the scientific community. In the conduct of our satellite and space probe experiments, we shall have broad participation by the scientific community and industry, as well as by other agencies of the Government, especially in the preparation of the instrumentation-payloads. We expect also to achieve a beginning measure of participation by the international scientific community, working with the Committee on Space Research (COSPAR) of the International Council of Scientific Unions.

The space sciences program as presently structured will be subject to continuing review, amplification, and modification. For convenience, the program has been divided into several areas of interest, including atmospheres, ionospheres, energetic particles, electric and magnetic fields, gravitational fields, astronomy, and bio-sciences. There will be, of course, considerable overlap among the different areas, and study of these various inter-relationships will be an important part of the program.

The vehicles to be used in performing the programmed space sciences experiments about 15 satellites and probes in calendar 1959 and as many more in calendar 1960. It is intended also to use some 40 sounding rockets in calendar 1959 and about a hundred in 1960. These are planning figures - they may change to some extent - but they are of the right order of magnitude.

Later presentations by NASA staff will provide more detail about these programs and, of course, about other activities planned for fiscal 1960 and the remainder of the current fiscal year.

Now, I want to discuss briefly certain aspects of our personnel and facilities planning which are fundamental to our operations.

As I have stated before, one of the great assets of NASA in these formative months has been the staff of nearly 8,000 scientists, engineering and supporting personnel, the $350,000,000 value of the finest of research facilities and the comprehensive flight research programs that we inherited from the National Advisory Committee for aeronautics. The record plainly shows there isn't an airplane flying today that doesn't reflect in many important ways the good results of NACA research. The same can be said for our missiles.

For the past several years - before establishment of NASA - the research programs at the NACA installations were being oriented increasingly to problems of space flight. This re-orientation is being extended, and we intend to do everything possible to assure that these research centers continue to perform work of great value. On the other hand, we must be vigilant in assuring that these same great centers program an adequate amount of research and development to support the rapidly changing aeronautics industry - both military and civilian. One vitally important action will be to provide the modern research facilities required, and we have budgeted $20,800,000 in fiscal 1960 for this purpose. Looking to the future, it may be expected that the annual expense of maintaining the necessary top quality of the research equipment will be as high or even higher.

At the present time, we plan no enlargement of staff at the former NACA research centers. The expansion of NASA effort, including deep involvement in such research, development and operational areas as electronics, guidance, rocket systems, etc., is being accomplished elsewhere both by the acquisition of a going concern, the Jet Propulsion Laboratory, operated by the California

Institute of Technology, and by the development of additional in-house capability at the new NASA Space Projects Center.

With the acquisition of the Jet Propulsion Laboratory, NASA obtained a high order of competence in electronics, guidance, propulsion, systems analysis, and in tracking and telemetry. Work is still in progress there on the Army's Sergeant missile, but by July 1 of next year, this project will have been phased out, and the entire 2300-man JPL organization will be working full-time on NASA space programs.

NASA does require, however, the additional capability to accomplish the necessary assembly and ground test of space vehicle systems, and also to supervise the subsequent launching operations. We had hoped, as I have previously said, to obtain this capability last October, together with the services of a highly competent engineering and design group that could become an integral part of our organization in the planning and executing both short and long-range programs in the development of boosters and vehicular systems, when we sought the transfer to NASA of a portion of the Army Ballistic Missile Agency at Huntsville, Alabama.

As I told your Committee last month, the Department of Defense felt unable to agree to the transfer. Instead, arrangements were made for the Army to be "completely responsive" to our requests for the performance of such work as we desire and which the Army feels can be done without interference to its military subjects. This arrangement will be re-examined during the current year; meantime, the Army has given every assurance of an earnest desire to cooperate, and we intend to make the fullest use possible, under these circumstances, of the ABMA capabilities.

NASA also acquired from the Navy, on October 1, the Vanguard Group, headed by Dr. John P. Hagen, together with 25 persons from other divisions of the Naval Research Laboratory who had spent substantially full time in support of this project, a total of 158 individuals. These Vanguard project people transferred to NASA so they could continue to work on this and future space science programs.

This group, beginning in 1955, had produced in a very short time a satellite launching vehicle that incorporated much in the way of advanced design. Its early flight experience was substantially the same as that of other missiles, whose failures and successes were not made public. Prior to Tuesday of this week, I had told Admiral Rawson Bennett, Chief of Naval Research, and Capt. P. H. Horn, commandant of the Naval Research Laboratory, that we in NASA were fully convinced of the inherent validity of the Vanguard project. And, when we took over October 1, NASA did its utmost to help the Vanguard Project Group in their work. What happened at 10:55 the morning of the 16th at Cape Canaveral justified our confidence and our effort.

Perhaps even more important, Vanguard's injecting into orbit of the cloud-cover experiment prepared by the U.S. Army Signal

Research and Development Laboratory at Fort Monmouth, N. J., marked the beginning of what may well become a new day in weather forecasting -- it was just a first step, but it was a step of very great significance. I am sure that Dr. John Hagen and his very competent people will continue to be employed to good purpose with even broader scope than in the past.

To recapitutate, NASA prefers to keep its own organization as small as is possible, consistent with performance of its missions. Using the NACA personnel complement at the beginning of fiscal 1959 of 7,892 as a frame of reference, we expect to count 8,961 employes on July 1, 1959, and 9,988 one year later. If, however, our experience demonstrates the necessity for us to develop from scratch the in-house capabilities we have hoped to acquire from ABMA, then we will need to enlarge our personnel complement by as much as 2,500 employes, and of course, will have to provide the new facilities needed for their use.

The fiscal 1959 supplemental estimate of $48,354,000 includes $3,354,000 for salaries and expenses. This item is to cover the cost of the salary increases provided for by the Classified Pay Act of 1958, and does not provide for additional positions.

The $20,750,000 in the supplemental estimate for Research and Development is entirely earmarked for our manned space flight program - Project Mercury. It is apparent that full exploitation of the potentialities of space flight for the benefit of mankind will be contingent upon the development of practical capabilities for operating manned space vehicles. The additional funds we are requesting for Project Mercury are to permit us to progress as rapidly as possible in this effort to prove our ability to send man into orbital flight and return him safely to earth.

The remainder of the '59 Supplemental Request consists of $24,250,000, of which the sum of $9,000,000 is required for new facilities, improvements to existing facilities, and about 70 acres of land, for the Jet Propulsion Laboratory; $12,050,000 for new tracking facilities which will be a part of the national space tracking system, and $3,200,000 for propulsion-development facilities to be used in testing of the 1-1½ million pound thrust, single chamber rocket engine.

The JPL money in large part is to permit relocation of various rocket test facilities and related equipment to a non-hazardous location where safety code standards can be met. At the present time, all but 10 of the 92 facilities on the laboratory site in Pasadena are non-comforming, and consequently to make necessary modifications to existing facilities to meet changing requirements would involve us in major alterations to bring the installation up to "code". The necessary land acquisition will cost $375,000 Relocation of utilities will total $2,775,200, and of test facilities $1,931,800. Modernization of support facilities will cost $2,255,000, and necessary new facilities will cost $1,488,000 plus $175,000 for a new substation and transformer pad.

The $12,050,000 requested for tracking facilities is needed now, because of the long lead times of much of the electronic gear. Extension of the Minitrack electronic tracking system by establishment of four new stations, located in Alaska, continental U. S., Newfoundland, and Europe, together with installations of improved equipment at other stations, will cost $3,300,000. Installations of radar dishes in Australia and South Africa will, when tied to the NASA-JPL station at Goldstone, Calif., enable the tracking of probes sent deep into space. The $3,500,000 will permit initiation of the procurement of the long-lead-time basic precision radar systems. The remaining $5,250,000 is for precision radar acquisition, tracking, communications, and associated systems, at a location in Southern Texas, for use tracking the mid-course re-entry and landing of Project Mercury orbital capsules.

To make this picture complete, I would like to speak very briefly about our budget request for FY 1960 and to make a few remarks about the future costs of these operations. The NASA budget estimates for fiscal 1960 total $485,300,000. They include increases in the salaries and expenses and construction and equipment items of $11,330,000 and $9,800,000, respectively, as compared to the same categories in the fiscal 1959 appropriations. The Research and development request, for $333,070,000, is an increase of $129,460,468 over fiscal 1959. These requests will, of course, be discussed in detail by others of the NASA staff at an appropriate time.

The point I want to make at this time is that these increases represent the accelerated level of space effort which we believe we can justify at this time. I emphasize, at this time, because we are now in the formative stages of one of the most challenging programs ever undertaken by the United States. The budget we have requested is what we need to do our job at present. We shall, of course, carry on a continuing, intensive review, not only of our presently scheduled programs, but also of what we should or could be doing in addition.

I should probably add the comment that, in my opinion, this is the last time that, at least in the foreseeable future, NASA will be requesting a budget of one-half billion dollars. If anything, the level of our space effort today is minimal if we are to reach our goals as promptly as we must. In these early stages of organizing, and planning, and beginning our programs, however, there are definite limits to the sums of money we can usefully spend.

Today, we are making the down payments on programs that, inevitably, will cost very much more in the years ahead. Project Mercury is budgeted at $37,661,200 in fiscal '59; we are asking for $20,750,000 in supplemental funds. The 1960 cost of Project Mercury is $70,000,000, and before we have completed this first U. S. effort to put man into space, the bill will have exceeded $200,000,000.

The 1-1½ million-pound-thrust engine is a $12,000,000 item in the 59 budget; its cost increases to $30,200,000 in the 1960 budget. Before this single-chamber booster has been brought to a state of usefulness, the cost will have exceeded $200,000,000. Everytime one of these giant boosters is used to send many tons of payload into space, we will be spending more than $20,000,000. I don't want to belabor the point,but I need to cite one final figure, the cost of the national booster program, to provide the building block units of basic rocket motors needed for our space programs, will exceed $2,000,000,000, in my opinion.

These are facts that must be considered now. The cost of our space programs will continue, year after year, and it will increase, year by year.

I couldn't begin to say precisely what the pay-offs will be, or how soon they will be realized. We expect that in the relatively near future, satellites will be widely used in meteorology -- witness the Vanguard II cloud-cover experiment -- and in world-wide communications. Experts in those fields have estimated that the value of such advances will be counted in the billions of dollars. Very great as such returns will be from our work in space, I have an inner conviction that in the years to come, there will be other gains from what we learn in space. They will be ones we don't even dream of today. They will be ones that will dwarf those we can only dimly see today.